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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 *attention 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 (Author et al., 2022; 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 (Martínez 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, Ford, Simmons, Gatward, & Meltzer, 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 X^2/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	<i>n</i>	<i>M</i>	<i>SD</i>	<i>Skew</i> <i>(SE)</i>	<i>Kurt.</i> <i>(SE)</i>	<i>Min.</i>	<i>Max.</i>
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**Boys (N=149)****Girls (N=162)**

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

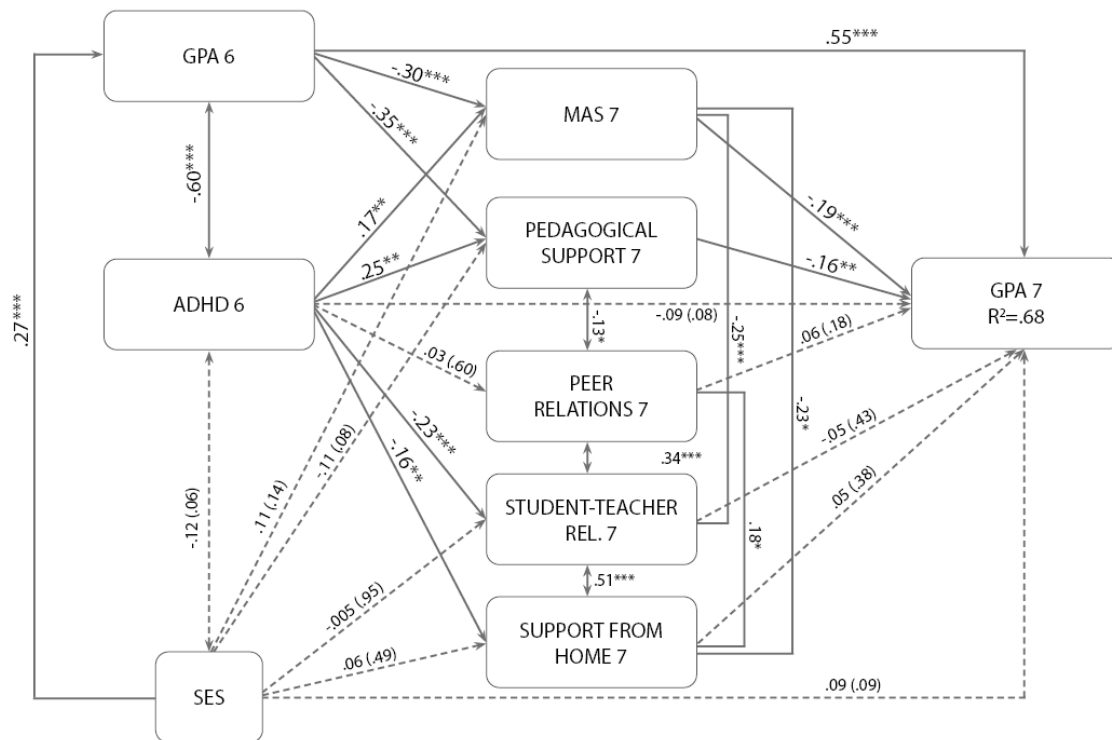
Variable	Boys		Girls		Cohen's <i>d</i>
	Mean (<i>SE</i>)	<i>SD</i>	Mean (<i>SE</i>)	<i>SD</i>	
ADHD symptoms (N=311)	3.56 (.24)	2.94	1.61 (.15)	1.92	-.79
Grade 6 GPA (N=285)	7.81 (.08)	.91	8.33 (.07)	.79	.61
Grade 7 GPA (N=251)	7.57 (.10)	1.12	8.17 (.09)	1.02	.56
MAS (N=226)	2.64 (.08)	.80	2.53 (.07)	.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

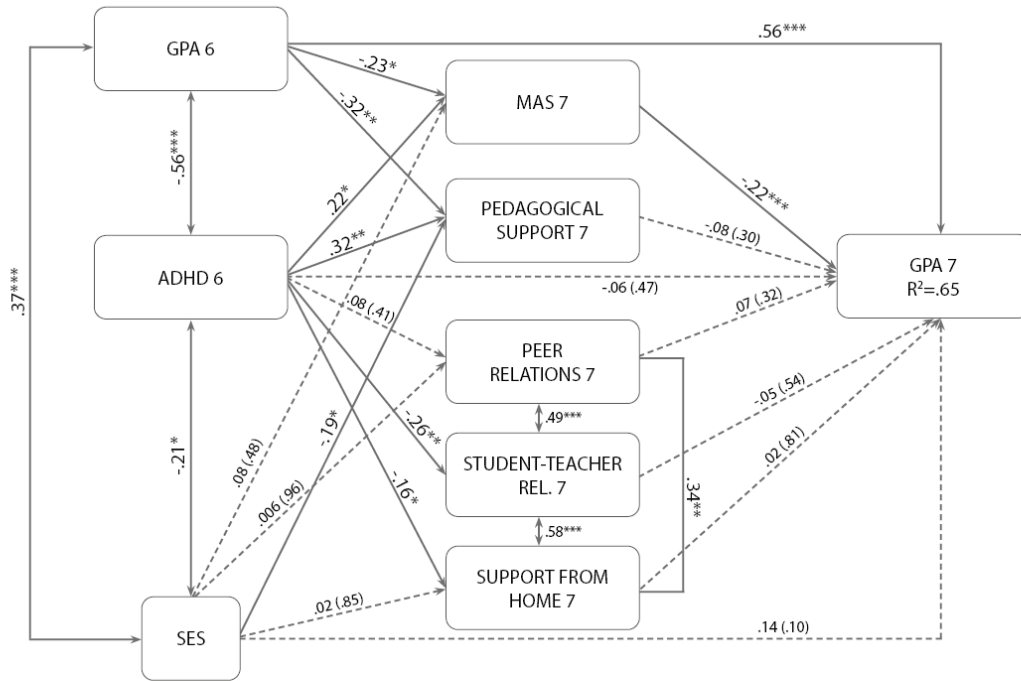
Next, we examined whether the same model fitted both girls and boys. In two sequential multigroup compared, the freely estimated model and the model where path coefficients for boys and girls were fixed equal and found that the CFI decreased from 1.00 to .94 indicating a poorer fit of the model that 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

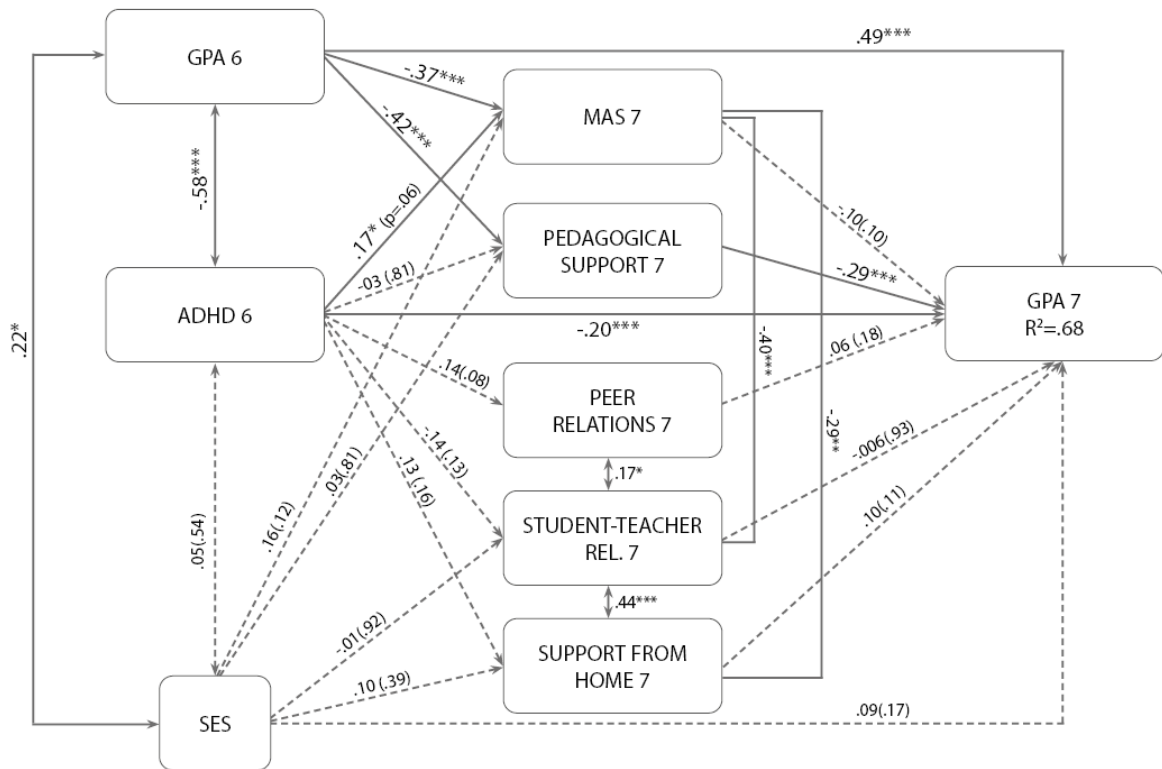


Note. GPA = Grade Point Average, ADHD 6 = hyperactivity/inattention symptoms on Grade 6, MAS = Maladaptive Achievement Strategies, Rel. = relationship. * $p < .05$ ** $p < .01$., *** $p < .001$. Dashed lines indicate non-significant paths.

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; Scitutto 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 (Martínez 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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