The relationship between competence-support/-thwarting and ADHD symptoms in children and the mediating effect of self-control
Abstract
To understand better the role basic psychological need satisfaction versus frustration may play in ADHD symptoms in children, this study researched the relationship between competence-support/thwarting and ADHD symptoms in children, based on the Self-Determination Theory (SDT). Self-control was included as a possible mediator. Participants (n=43) were Dutch school children aged 8-13. Competence-support and –thwarting were measured with children and parents ratings, using a Dutch translation for the Interpersonal Behaviors Questionnaire (IBQ). Additionally, parents rated child ADHD symptoms using the Strengths and Weaknesses of ADHD symptoms and Normal behavior (SWAN), and self-control was measured using the percentage false alarms on a go/no-go task.
Competence-thwarting, but only when assessed by parents, correlated negatively with child ADHD symptoms. Competence-support did not correlate significantly with ADHD symptoms, and self-control did not correlate significantly with competence-support, competence-thwarting or ADHD symptoms. Self-control did not mediate the association between competence thwarting and ADHD symptoms. In conclusion, higher levels of competence-thwarting correlated with ADHD symptoms, but self-control did not play a mediating role in this association. Because no claims regarding directionality could be made, longitudinal research is needed to determine whether parents’ competence thwarting leads to higher levels of ADHD in their child over time, or whether children’s ADHD symptoms predict parents’ competence thwarting over time, or whether this association may be bidirectional in nature. Eventually, this work may inform interventions that focus on enhancing parenting strategies in parents of children with ADHD.

Introduction
ADHD is a neurodevelopmental disorder characterized by inattention, hyperactivity and/or impulsivity (American Psychiatric Association, 2013) and is best viewed as an interaction between genes and environment (Barkley, 2006). In accordance with this, Larsson, Larsson & Lichtenstein (2004) concluded that a change in ADHD symptoms between childhood and early adolescence was to a large extent due to new genetic effects in early adolescence but also due to new non-shared environmental effects. This suggests that ADHD symptoms can change and be changed. Indeed, an experimental study concluded that constructive training in parenting strategies caused a reduction in ADHD symptoms (Sonuga-Barke, Daley, Thompson, Laver-Bradbury, & Weeks, 2001). It is argued that the fundamental
deficit behind inattention, hyperactivity and impulsivity is difficulty with self-control (Barkley, 2005) as children with ADHD are known for poor self-control (Modesto-Lowe, Danforth& Brooks, 2008). Barkley (1997) posits that poor self-control is what expresses as distractibility (inattention) and impulsivity-hyperactivity. In the context of ADHD symptoms, self-control is defined as the ability to inhibit or postpone behaviour as needed (Tangney, Baumeister& Boone, 2004). In addition to relatively weak inhibitory control, altered motivation has been theorized to play a key role in ADHD (Sonuga-Barke 2002, 2003, 2005; Haenlein& Caul, 1987; Sagvolden, Johansen, Aase, & Russell, 2005). In these theories, motivation is typically operationalized as the way in which individuals process external reinforcers/rewards. In line with these models, empirical work on this topic is largely limited to effects of external reinforcers on behaviour/performance in ADHD. A study investigating the effects of motivational incentives on inhibition found evidence supporting a motivational explanation of the origins of lowered inhibitory control in children with ADHD (Slusarek, Velling, Bunk, & Eggers, 2001). Later, Geurts, Luman& Van Meel (2008) found larger positive effects of social motivation on interference control in children with ADHD compared with controls. A meta-analysis by Ma, van Duijvenvoorde & Scheres (2016) demonstrated impaired inhibitory control during non-reinforced condition in children with ADHD and found that reinforcing correct inhibition leads to normalization of inhibition to the baseline level of performance of controls in children and adolescents with ADHD.

Although ADHD theories that include motivation as a key factor mostly focus on extrinsic motivation, general motivation theories utilize a much richer definition of motivation. The self-determination theory (SDT) sets itself apart by not treating motivation as a unitary concept that differs in amount but not type, but rather focus on differentiating types of motivation in order to make predictions about performance and psychological-health outcomes. The theory distinguishes between autonomous motivation (intrinsic motivation and well-internalized extrinsic motivation) and controlled motivation, extrinsic motivation, or regulation by external factors (Deci& Ryan, 2008). Intrinsic motivation reflects the natural human propensity to learn and assimilate (Ryan &Deci, 2000). The SDT posits that there are three basic psychological needs that either enhance or undermine intrinsic motivation, self-regulation and well-being: competence (the need to be effective in dealing with the environment), autonomy (the need to control the course of your own life) and relatedness (the need to have a close and affectionate relationship with others) (Ryan &Deci, 2000). The maintaining of intrinsic motivation and internalizing extrinsic motivation is facilitated by social contexts that allow satisfaction of the three basic psychological needs: such contexts are
characterized by the provision of choice (support autonomy), optimal challenge (supports competence), informational feedback (supports competence), interpersonal involvement (supports relatedness) and acknowledgment of feelings (supports relatedness) (Deci, Ryan, & Williams, 1996). On the other hand, social contexts that forestall the need for autonomy, competence and relatedness have a tendency to lead to people adopting extrinsic goals which fail to foster integration or wellness even when attained (Deci & Ryan, 2008).

The SDT can offer a useful framework in the study of ADHD. Although hardly applied yet to the study of ADHD, a few studies have used this theory to test certain hypotheses about ADHD. Guided by the SDT, one study found that children with ADHD symptoms perceived their classrooms as more controlling, reported more feelings of incompetence and reported more negative relationships with their teachers, suggesting that ADHD symptoms may uniquely interfere with children’s fulfilment of basic psychological needs in the classroom setting (Rogers, & Tannock, 2013). Out of the three basic psychological needs presented by the SDT, most studies have been aimed at the need for autonomy: findings include that the promotion of autonomy has generally been associated with increased intrinsic motivation, greater interest, less pressure and tension, more creativity, more cognitive flexibility, better conceptual learning, more positive emotional tone, higher self-esteem, more trust, greater persistence of behaviour change and better physical and psychological health, compared to controlling autonomy (Deci, & Ryan, 1987). However, Rocchi, Pelletier, Cheung, Baxter & Beaudry (2017) argue that all three needs are essential.

The basic need of competence is of particular interest to the study of ADHD and shall be the focus in this current study. The concept of competence was introduced as previous theories of motivation, built upon primary drives, were unable to account for playful and exploratory behaviour which furthers the learning process of effective interaction with the environment: this intrinsic need to deal with the environment leads to a feeling of efficacy (White, 1959). It seems that receiving informational feedback plays a large part in fulfilling the need for competence: giving positive feedback increases people’s intrinsic motivation and decreases extrinsic motivation for a task (Deci, 1971), while negative feedback decreases intrinsic motivation and perceived competence (Vallerand, & Reid, 1984). Findings indicate that ADHD differentially affects processing of positive and negative feedback during guessing, suggesting an enhanced sensitivity to unfavourable outcomes in children with ADHD (Van Meel, Oosterlaan, Heslenfeld, & Sergeant, 2005). In another study, boys with ADHD exhibited higher performance (similar to the non-ADHD boys control group) on visuospatial working memory tasks when they received feedback associated with large-
reward, compared to when no feedback was available and/or the reward was small (Hammer et al., 2015). This is where ADHD and competence overlap: findings suggest that ADHD children show greater improvement in cognitive task performance with reinforcement (e.g. positive feedback or rewards) than controls do, due to a heightened trait sensitivity to reward (Fosco, Hawk, Rosch, & Bubnik, 2015).

Therefore, it is of interest to study whether thwarting or supporting competence may play a role in ADHD. Competence-support entails the showing of positive expectations and acknowledging and encouraging the improvement of skills, and competence-thwarting entails the emphasizing of mistakes and the discouraging of trying out difficult things (Sheldon & Filak, 2009). As stated above, children with ADHD are sensitive to feedback and reinforcement, and this may in turn impact their feeling of competence. However, in terms of social participation in academia, compared to controls, kids with ADHD more often repeat grades, make more use of remedial academic services and are placed in special education classes more often (Biederman et al., 1996) and they are more likely to be expelled, suspended or repeat a grade compared with controls (LeFevers, Villers, Morrow, & Vaughn, 2002), which may lead to lower experienced competence. This current study posits that due to the difficulties children with ADHD experience concerning inattention, hyperactivity and impulsivity, children in classroom settings experience more negative feedback than their non-ADHD counterparts which then might lead to a decrease in their sense of competency. However, the opposite might then also be true, as supporting competency increases motivation and cognitive performance, it might lead to a reduction in ADHD symptoms.

In addition, the possibility that the expected relation between competency and ADHD symptoms is mediated by poor self-control will be explored. Previous research has shown the link between ADHD symptoms and poor self-control (Willcutt, Doyle, Nigg, Faraone & Pennington, 2005), and that the thwarting of the three psychological needs leads to compensatory behaviour like lower self-control (Vansteenkiste & Ryan, 2013). And, as stated earlier, poor self-control is thought to be and has shown to be a fundamental deficit playing a role in ADHD symptoms (Barkley, 1997; Willcutt et al., 2005): therefore, in the case of full mediation, a possible implication of this could be that supporting competence could be a different and possibly more positive way of enhancing self-control and reducing ADHD symptoms. As stated earlier, ADHD symptoms can change over time as a product of genetic and environmental effects. Despite being more sensitive to feedback than non-ADHD children, a mother-child interaction study by Mash and Johnston (1982) showed that mothers of hyperactive children were generally more directive and negative during play and less
responsive to child-initiated interactions and that during a structured-task situation these mothers were more directive and negative and less interactive and approving. The hyperactive children themselves asked more questions and were generally more negative and noncompliant during play (especially younger hyperactive children). It seems there is a tendency in parents of children with ADHD to utilize a more negative and need-thwarting style of parenting, rather than being positive and need-supporting. The results of this current study may yield insights into the role competence support/thwarting may play in ADHD symptoms, and may form a first step towards developing specific advice to parents of children with ADHD regarding competence support/thwarting.

This current study aims to answer two questions: 1) what is the effect of competence-support and -thwarting by a parent on ADHD symptoms of children? And 2) are these effects mediated by self-control? Based on the SDT and previous studies, this study hypothesizes that 1a) competence-support is associated with lower levels of ADHD symptoms, 1b) competence-thwarting is associated with higher levels of ADHD symptoms, and 2) self-control partially mediates these relations. Specifically, 1a) is expected to be mediated by relatively strong self-control and 1b) by relatively weak self-control.

Methods

Participants

Participants were 51 children and one parent per child, recruited through a primary school in the Netherlands. The results of eight children and their parent were omitted in the data-analysis: four due to technical problems, three due to illness at the time of the experiment and one due to missing parent questionnaires. The final dataset contains the results of 43 children (n = 43). Their ages range between 8.4 years and 13.0 years (M = 11.1 years, SD = 1.1 year). Of 38 (88%) of the children permission was granted by their mother and of 5 (12%)

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1 All participants were gathered prior to the start of this current study. In compliance with course requirements, alternative activities were performed in service of other ongoing research.\(^1\)

2 Gender-based statistics are unavailable as the original study did not include this information in the dataset used for this current study.
of the children permission was granted by their father. All children and their parents were of
the Dutch nationality. All participants participated on a voluntary basis.

Materials

In order to measure competence-support and thwarting we used SDT-based
questionnaires on need fulfilment filled in by the child and one of their parents. The
questionnaire for children was a Dutch translation of the English Interpersonal Behaviors
Questionnaire (IBQ) and the questionnaire for the parents was a Dutch translation of the
English Interpersonal Behaviours Self-Report Questionnaire (IBQS; Rocchi et al., 2017). The
Dutch version is based on a translation for a study regarding sports at Leuven University (De
Muynck, unpublished).

Both questionnaires are composed of 24 items divided into three scales: autonomy,
competence and relatedness with 8 items each. The competence scale, which we use here, is
divided into two subscales with 4 items each: competence-support and competence-thwarting.
Both questionnaires took about 15 minutes to complete.

The children were asked to rate their parents’ behaviour: each item was a statement
and the children had to judge whether they agreed or disagreed with it on a seven-point-scale
ranging from “completely disagree” (1) to “completely agree” (7). One example of such a
statement is “He/she encourages me to improve my skills”. Parents were asked to rate their
own behaviour towards their child, also on a seven-point scale. An example of an item on the
IBQS is “I encourage him/her to improve his/her skills”. The minimum score for both the
subscales competence-support and competence-thwarting was 4 and their maximum scores
were 28.

The English version of the IBQ regarding competence-support had a Cronbach’s alpha
between 0.75 and 0.82 and competence-thwarting had a Cronbach’s alpha between 0.77 and
0.84 (Rocchi et al., 2017). The internal consistency ranges from acceptable to good. The
English version of the IBQS has a Cronbach’s alpha of 0.77 for competence-support
(acceptable internal consistency) and a Cronbach’s alpha of 0.82 for competence-thwarting
(good internal consistency) (Rocchi et al., 2017). In this study, the Dutch version of the IBQ’s
competence-support scale was found to have a Cronbach’s alpha of 0.37 (unacceptable) and
the competence-thwarting scale a Cronbach’s alpha of 0.54 (poor). In this study, the Dutch
version of the IBQS’ competence-support scale was found to have a Cronbach’s alpha of .32
(unacceptable) and the competence-thwarting scale a Cronbach’s alpha of .51 (poor).

A measure of ADHD symptoms in the participating children was made using the
Strengths and Weaknesses of ADHD symptoms and Normal behaviour rating scale (SWAN) (Swanson et al., 2012). This current study uses a Dutch translation of the SWAN, used previously in a twins study regarding ADHD (Polderman et al., 2017). The SWAN is made up out of 18 items, to be filled in by a parent of children and adolescents up to 18 years. The parent scores how well or poorly their child does in paying attention, sitting still (hyperactivity), waiting for their turn (impulsivity) compared to other children on a seven-point-scale ranging from “far below average” (1) to “far above average” (7). Examples of statements on the SWAN are “ignoring external stimuli” and “remain seated when required”. The SWAN is based on the DSM 5-criteria for ADHD and it measures this using a dimensional approach, rather than a categorical approach (deficit or no deficit). Each scale has a minimum score of 9 and a maximum score of 63, and the SWAN’s total minimum score is 18 and its total maximum score is 126. A lower score (below average) means a higher difficulty regarding the corresponding scale (Polderman et al., 2007). Lakes, Swan son and Riggs (2012) judged the English version of the SWAN as both reliable and valid. Because of its dimensional way of measuring behaviour, the SWAN yields a normal distribution of scores in the general population (Swanson et al., 2012) and has a wider scope than alternative ADHD questionnaires (Polderman et al., 2007). The scale inattention has a Cronbach’s alpha of 0.90 and the scale hyperactivity/impulsivity has a Cronbach’s alpha of 0.94, meaning both SWAN scales have a high internal consistency. In this study, a total ADHD score, summing up the two subscales, was used, with lower scores reflecting more ADHD-related difficulties. This questionnaire takes about 15 minutes to complete.

Self-control was measured using a computerized go/no-go task. In this task the participant was asked to react as quickly and accurately as possible on a series of stimuli (go signals), which causes a strong tendency to react (Wright, Lipsyc, Dupuis, Thayapararajah, & Schachar, 2014). However, in 25% of the task a no-go signal was presented rather than the go signal, and participants were required not to respond. The eventual measure used was the percentage of commission errors (percentage of no-go trials on which reactions were given, or “false alarms”). A higher percentage of false alarms means worse inhibition or less self-control (Wright et al., 2014). The children were presented with a trial round during which they received feedback on their reaction and five rounds during they received no feedback. Each round had 48 trials with 36 no-go signals and 12 go signals. This study used an image of Lisa Simpson as the go signal and a picture of Bart Simpson as the no-go signal, both from the animated television show The Simpsons. This task took about 20 minutes to complete.
**Procedure**

Participants were recruited through an elementary school in the fifth, sixth, seventh and eighth grade. First the children were shown an animated movie in order to inform and enthuse them about the research. Next, the children were asked to bring home an information letter and a consent form, asking the parents to actively agree to allow the use of the encoded and anonymous data procured by the study. Both the children and the parents could abort their participation in the study at any moment without the need to provide a reason why.

There were two moments of testing. During the first, the children were asked to complete a questionnaire regarding their experienced need-support and need-thwarting by their parents. During the second moment of testing, they were asked to perform a computerized go/no-go task. Both the questionnaire and the computer task respectively were completed by all the children in one class simultaneously. Parents received their questionnaires in paper form through their children, and either the mother or father filled them in. Based on which parent filled in the questionnaires, one of the two questionnaires filled in by the children was used: if the father completed the parent questionnaires, the child questionnaire reporting on need support by the father was used, and vice versa if the mother completed the parent questionnaires. Corresponding to which parent filled in their questionnaire, the other was not. Part of the results was reflected back to the parents when the testing concluded.

All obtained data was stored according the guidelines of the Behavioral Science Institute (BSI) of the Radboud University Nijmegen (Cillessen & Gommans, 2017). The Ethics Committee Social Sciences (ECSS) of the Radboud University Nijmegen granted permission for this research (code: ECSW2017-3001-479).

**Data-analysis**

The two independent variables competence-support and competence-thwarting were calculated by adding up the scores of the four items per subscale and for each, there were two measures: competence-support and competence-thwarting by one of the parents as perceived by the child (IBQ) or as perceived by the parent (IBQS). On both the questionnaires, both the subscales competence-support and competence-thwarting have a minimum score of 4 and a maximum score of 28.

The dependent variable was the total score on the SWAN questionnaire. The minimum score was 18, indicating a lot of ADHD-related difficulties, and the maximum score was 126, indicating very few ADHD-related difficulties. Thus, a lower score means more ADHD
symptoms.

The mediator self-control was measured using the percentage of false alarms (errors of commission) on the go/no-go task.

Using IBM Statistical Package for the Social Sciences (SPSS) software reliability analyses were performed for the SWAN, the competence-support subscales on the IBQ and IBQS and for the competence-thwarting subscales on the IBQ and the IBQS. Next, several correlations were calculated between the independent variables, the dependent variable, and the mediator. Because the correlation between the IBQ competence-support and –thwarting and the correlation between the IBQS competence-support and –thwarting were lower than 0.7, the mediation analyses were performed using both the IBQ and IBQS separately on the respective subscales.

Before the mediation analyses were performed, the assumptions for regression (linearity, homoscedasticity and normality) were checked. The SPSS macro PROCESS with model number 4 was used (Hayes, 2013), as the often used four steps for testing mediation (Baron & Kenny, 1986) is a liberal method and as such it has a high type I error, which is why it is urged to use this test only as a supplement to other methods (Fritz, Taylor, & MacKinnon, 2012). Four mediation analyses were performed: the independent variable on the first was competence-support according to the IBQ, on the second analysis it was competence-support according to the IBQS, on the third analysis the independent variable was competence-thwarting according to the IBQ and the independent variable on the fourth was the competence-thwarting according to the IBQS. In all analyses, the dependent variable was ADHD symptoms and the mediator was self-control (percentage false alarms).

**Results**

The independent variables competence-support and competence-thwarting were judged by the children (IBQ) and a parent (IBQS). Low scores on competence-support mean the parent and/or child assess the parenting style utilized as one that does not offer much fulfilment in the child’s need for a sense of competence, whereas high scores do. Low scores on competence-thwarting indicate a parenting style that does not actively thwart the sense of competence, whereas high scores do. ADHD symptoms are measured with the SWAN, where lower scores mean more ADHD symptoms. Self-control is measured with a go/no-go task, where lower scores mean better self-control skills. See table 1.
### Table 1. Descriptive statistics

<table>
<thead>
<tr>
<th></th>
<th>Minimum sample</th>
<th>Maximum sample</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competence support by parent (Range: 4-28)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>According to child (IBQ)</td>
<td>10</td>
<td>28</td>
<td>22.95</td>
<td>3.7</td>
</tr>
<tr>
<td>According to parent (IBQ-S)</td>
<td>18</td>
<td>28</td>
<td>23.35</td>
<td>1.94</td>
</tr>
<tr>
<td>Competence thwarting by parent (Range: 4-28)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>According to child (IBQ)</td>
<td>4</td>
<td>16</td>
<td>7.95</td>
<td>3.68</td>
</tr>
<tr>
<td>According to parent (IBQ-S)</td>
<td>4</td>
<td>16</td>
<td>8.26</td>
<td>2.6</td>
</tr>
<tr>
<td>ADHD symptoms(^1) (SWAN) (Range 18-126)</td>
<td>38</td>
<td>114</td>
<td>73.14</td>
<td>16.33</td>
</tr>
<tr>
<td>Self-control (% errors of commission go/no-go task)(^2)</td>
<td>0</td>
<td>38.33</td>
<td>14.09</td>
<td>9.83</td>
</tr>
</tbody>
</table>

\(^1\)A lower score means more difficulties regarding the scales Attention and Hyperactivity/Impulsivity

\(^2\)A lower percentage errors of commission indicates better self-control skills

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**Correlation between competence-support and –thwarting judged by parent and child**

Both competence-support and competence-thwarting by a parent were judged by the parent themselves (IBQS) and by their child (IBQ). The correlation between competence-support on the IBQS and IBQ was non-significant and weak positive ($r (43) = 0.284$, $p = 0.065$). The correlation between competence-thwarting on the IBQS and IBQ is non-significant ($r (43) = 0.063$, $p = 0.686$). As the correlations between IBQ and IBQS competence-support and IBQ and IBQS competence-thwarting were lower than 0.7, the mediation analyses were performed using the measures judged by the children (IBQ) and their parents (IBQS) separately. Correlations between the independent variables (competence), dependent variable (ADHD symptoms), and mediator (self-control) are presented in Table 2 (below).

### Table 2. Correlations (Pearson’s $r$) between all variables ($N = 43$)

<table>
<thead>
<tr>
<th>Variable</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Competence-support judged by child (IBQ)</td>
<td>.28</td>
<td>-.03</td>
<td>-.06</td>
<td>-.24</td>
<td>-.18</td>
</tr>
<tr>
<td>2. Competence-support judged by parent (IBQS)</td>
<td>.2</td>
<td>-.1</td>
<td>.16</td>
<td>.08</td>
<td></td>
</tr>
<tr>
<td>3. Competence-thwarting judged by child (IBQ)</td>
<td>.06</td>
<td>.02</td>
<td>.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Competence-thwarting judged by parent (IBQS)</td>
<td></td>
<td></td>
<td></td>
<td>-.8</td>
<td>-.34*</td>
</tr>
<tr>
<td>5. Self-control (% falsealarms)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.05</td>
</tr>
<tr>
<td>6. ADHD symptoms (SWAN)</td>
<td></td>
<td></td>
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</table>

Note: *$p < .05$. ** $p < .01$
Mediation analysis (SPSS: PROCESS, with model number 4) was used to investigate the hypothesis that self-control mediates the effect of competence-support and competence-thwarting on ADHD symptoms in children.

*Competence-support judged by parents (IBQS)*

In Step 1 of the mediation model, the regression of ADHD symptoms in children on competence-support as judged by parents (IBQS), ignoring the mediator, was not significant, thereby not supporting hypothesis 1a. $b = 0.69$, $t(41) = 0.53$, $p > .05$ with $F(1,41) = 0.28$ and $R^2 = .007$. Step 2 showed that, contrary to what was expected, ADHD symptoms were not significantly related with weak self-control. $b = 0.8$, $t(41) = 1.02$, $p > .05$ with $F(1,41) = 1.05$ and $R^2 = .03$. Step 3 of the mediation process, with $F(2,40) = 0.17$ and $R^2 = .008$, showed that the mediator self-control, controlling for competence-support as judged by parents, was not significant: competence-support (as judged by parents) is not associated with more self-control in children, $b = 0.07$, $t(40) = .25$, $p > .05$. Step 4 of the analyses revealed that, controlling for self-control, competence-support (IBQS) scores were not a significant predictor of ADHD symptoms in children, $b = 0.64$, $t(40) = 0.47$, $p > .05$. These findings do not support the mediation hypothesis, nor do they support the hypotheses that ADHD symptoms would be associated with less self-control and with less competence support.

*Competence-support judged by children (IBQ)*

In Step 1 of the mediation model, the regression of ADHD symptoms in children on competence-support as judged by children (IBQ), ignoring the mediator, was not significant, thereby not supporting hypothesis 1a. $b = -0.79$, $t(41) = -1.17$, $p > .05$ with $F(1,41) = 1.37$ and $R^2 = .03$. Step 2 showed that, unexpectedly, ADHD symptoms are not significantly associated with self-control. $b = -0.66$, $t(41) = -1.64$, $p > .05$ with $F(1,41) = 2.70$ and $R^2 = .06$. Step 3 of the mediation process, with $F(2,40) = 0.67$ and $R^2 = .03$, showed that the mediator self-control, controlling for competence-support as judged by children, was not significant: competence-support (as judged by children) is not associated with higher self-control in children $b = 0.01$, $t(40) = 0.05$, $p > .05$. Step 4 of the analyses revealed that, controlling for self-control, competence-support (IBQ) scores were not a significant predictor of ADHD symptoms in children, $b = -0.78$, $t(40) = -1.11$, $p > .05$. These findings do not support the mediation hypothesis, nor do they support the hypotheses that ADHD symptoms would be associated with less self-control and with less competence support.
Competence-thwarting judged by parents (IBQS)

In Step 1 of the mediation model, the regression of ADHD symptoms in children on competence-thwarting as judged by parents (IBQS), ignoring the mediator, was significant: as expected, competence-thwarting was associated with relatively high levels of ADHD symptoms, \( b = -2.15, t(41) = -2.34, p < .05 \) with \( F(1,41) = 5.48 \) and \( R^2 = .12 \). Step 2 showed that the regression of the ADHD symptoms scores on the mediator, self-control, was not significant, \( b = -0.3, t(41) = 0.51, p > .05 \) with \( F(1,41) = 0.26 \) and \( R^2 = .006 \). Step 3 of the mediation process, with \( F(2,40) = 2.69 \) and \( R^2 = .12 \), showed that the mediator self-control, controlling for competence-thwarting as judged by parents, was not significant: competence-thwarting (judged by parents) is not associated with low self-control in their children, \( b = 0.04, t(40) = 0.17, p > .05 \). Step 4 of the analyses revealed that, controlling for self-control, competence-thwarting (IBQS) scores were still a significant predictor of ADHD symptoms in children, \( b = -2.14, t(40) = -2.29, p < .05 \). A main effect was found for competence-thwarting as judged by parents on ADHD symptoms in their children: \( R^2 = .12 \), meaning 12% of a child’s ADHD symptoms can be explained by their parent’s self-judged competence thwarting. This main effect is significant and moderate negative. These findings do support the hypothesis that ADHD symptoms would be associated with more competence thwarting. However, it appears that there is no mediating effect of self-control. The indirect effect was -0.0125. The significance of this indirect effect has been tested by means of bootstrapping. This was done on the basis of 5000 samples with the confidence interval of 95%. The indirect effect of the bootstrapping was -0.0125 with a 95% confidence interval from -0.3185 to 0.2922. This indirect model is not significant and there is no (partial) mediation. As the regression of the ADHD symptoms scores on the mediator were found to be non-significant, these findings do not support the mediation hypothesis.

Competence-thwarting judged by children (IBQ)

In Step 1 of the mediation model, the regression of ADHD symptoms in children on competence-thwarting as judged by children (IBQ), ignoring the mediator, was not significant: unexpectedly, competence-thwarting as perceived by children did not go together with higher ADHD symptoms, \( b = 0.5, t(41) = 0.73, p > .05 \) with \( F(1,41) = 0.53 \) and \( R^2 = .01 \). Step 2 showed that the regression of the ADHD symptoms scores on the mediator, self-control, was not significant, \( b = 0.06, t(41) = 0.15, p > .05 \) with \( F(1,41) = 0.02 \) and \( R^2 = .0006 \). Step 3 of the mediation process, with \( F(2,40) = 0.31 \) and \( R^2 = .02 \), showed that the
mediator self-control, controlling for competence-thwarting as judged by children, was not significant: competence-thwarting (judged by children) is not associated with low self-control, b = 0.08, t(40) = 0.71, p > .05. Step 4 of the analyses revealed that, controlling for self-control, competence-support (IBQ) scores were not a significant predictor of ADHD symptoms in children, b = 0.5, t(40) = 0.71, p > .05. These findings do not support the mediation hypothesis, nor do they support the hypotheses that ADHD symptoms would be associated with less self-control and with more competence thwarting.

**Discussion**

This study aimed to find out what relationship exists between competence-support and -thwarting by parents on the one hand, and ADHD symptoms in their children on the other, and whether self-control has a mediating effect in this relationship. It was theorized that competence-support would be associated with less ADHD symptoms and that competence-thwarting would be associated with more ADHD symptoms, both through a (partially) mediating effect of self-control. These hypotheses were based on previous findings that poor self-control was an important contributing factor to ADHD symptoms (Barkley, 2005), that people with ADHD are more sensitive to reinforcement than their peers and the feeling of competence rises and falls with positive and negative reinforcement and that the thwarting of competence (along with autonomy and relatedness) has been shown to lead to a decrease in self-control. This current study found a significant correlation between competence-thwarting judged by parents and ADHD symptoms in their children (also judged by parents): 12% of ADHD symptoms could be explained by competence-thwarting measures as judged by parents. However, there was no mediating effect of this association by self-control. As opposed to the relation between ADHD symptoms and competence-thwarting as rated by parents, no significant effects of competence-thwarting as judged by children were found on ADHD symptoms. Furthermore, competence support, whether rated by parents or children, was not significantly associated with ADHD symptoms. Finally, contrary to our assumption, ADHD symptoms were not significantly associated with poor self-control in this study.

Theoretical and practical implications for these findings will be discussed.

The first hypothesis in this current study was that competence-support has an indirect, positive relationship with ADHD symptoms through self-control: this hypothesis could not be proven, despite earlier findings by Rogers and Tannock (2012) that children with fewer ADHD symptoms experienced more competence (and autonomy and relatedness) in
classroom settings. A possible explanation for this might be that in this current study, competence-support was estimated by parents and not teachers. However, these findings are in line with the findings of an earlier study that showed that no relationship existed between ADHD symptoms and positive parenting factors (Park, Hudec & Johnston, 2017).

This study’s second hypothesis was that competence-thwarting has an indirect, negative relationship with ADHD symptoms through self-control. Although competence-thwarting judged by parents indeed had a significant and moderate negative effect on ADHD symptoms in children as judged by parents, this was not the case for competence-thwarting as perceived by children. Furthermore, self-control did not mediate the association between parent-rated competence-thwarting and ADHD symptoms in children. The negative effect of competence-thwarting on ADHD symptoms corresponds with earlier findings, such as Park’s et al. (2017) findings that there is a relationship between ADHD symptoms and negative parenting factors, such as strict and neglectful parenting, Modesto-Lowe’s et al. (2008) findings that parents of children with ADHD utilize a less responsive and more critical parenting style, and Rogers and Tannock’s (2013) study which showed that children with ADHD reported higher levels of feelings of incompetence in their classroom settings. Why only competence-thwarting and not competence-support was found to have a significant effect on ADHD symptoms may be explained by the findings of a study performed by Van Meel, Oosterlaan, Heslenfeld, & Sergeant (2005), which suggests that children with ADHD have an enhanced sensitivity to unfavourable outcomes. Similarly, competence-thwarting is likely experienced as negative, and may have a bigger impact than competence-support, which may be experienced as positive. This would also fit with a more general literature that has shown that negative experiences have bigger impacts on people than positive experiences, known as the sign-effect (Baumeister et al., 2001). The fact that competence-thwarting only had a significant correlation with ADHD symptoms when it was judged by the parents and not the child, could perhaps be explained by an informant effect: possibly, the correlation between ADHD symptoms as rated by the parents and competence-thwarting as rated by the parents was significant due to within-subject factors. This measure of ADHD only reflects the view of the parents, and a significant correlation between two scores judged by the same person might then be more likely. Therefore, it would be helpful to add a SWAN self-report for the children in future research, to check whether the relation between competence-thwarting as perceived by the child may correlate with ADHD symptoms as perceived by the child. Regardless, the second mediation hypothesis was not supported, as adding self-control as a mediator to the model did not change the association between parent-rated competence thwarting and ADHD symptoms.
The third hypothesis in this study was that the relationship between competence-support/thwarting and ADHD symptoms was partially mediated by self-control. However, the findings in this study did not support this hypothesis as no statistically significant association was found between either competence-thwarting/support and self-control or between self-control and ADHD symptoms. This despite Barkley’s (2005) claim that the fundamental deficit behind ADHD is poor self-control and Vansteenkiste and Ryan’s (2013) finding that need-thwarting leads to diminished self-control. This might possibly be explained by the go/no-go task used in this current study. The maximum error percentage was 37%: this corresponds with remarks made by participating children, stating that they felt the task was easy. This could mean that the go/no-go task failed to provide an accurate estimation of the children’s self-control, and that children with poor self-control still managed to perform well on this task. Future research should take this into account. A possible solution is to increase the difficulty of the go/no-go task by shortening the inter-stimulus interval, which is the temporal interval between the offset of one stimulus and the onset of the next. Another way to make the task more difficult would be to lower the percentage of no-go trials, which would increase the potency of the go-response, which in turn may make it harder to inhibit. A final solution could be to replace the go/no-go task: studies have shown that self-control tasks, such as the go/no-go task, correlate poorly with measures of self-control. Instead, the best predictors are observational questionnaires, filled in for example by parents or teachers (Duckworth & Kern, 2011).

Theoretical implications of the findings in this current research concern the possibility that competence-thwarting parenting styles may attribute to the development of ADHD in children. As previous studies have shown constructive parenting strategies to reduce ADHD symptoms (Sonuga-Barke et al., 2001), a closer look at the relationship between negative parenting and the origination of ADHD may be warranted. A broader theoretical implication is that the SDT seems to be a relevant framework to better understand ADHD and its development.

Practical implications of these findings concern the parenting styles utilized by parents when dealing with their children with ADHD. Although no proof could be found that competence-support by parents is associated with lower levels of ADHD symptoms in their children, a significant correlation between competence-thwarting and increased ADHD symptoms was found. Whether this means that a competence-thwarting style by parents leads to ADHD symptoms in their children, or whether it means that ADHD symptoms in children
lead to parents using a competence-thwarting style, the importance of NOT using a competence-thwarting parenting style is highlighted. Previous studies show that parent ADHD is correlated with variation in parenting behaviour, which is associated with offspring ADHD (Banks, Ninowski, Mash, & Semple, 2008; Ellis & Nigg, 2009) and that parenting behaviour contributes to the developmental course of childhood ADHD (Alizadeh, Applequist, & Coolidge, 2007). Parents with elevated ADHD symptoms use maladaptive discipline (Banks et al., 2008) and parent ADHD symptoms are positively associated with inconsistent discipline and nonsupportive responses to offspring negative emotions (Mokrova, O’Brien, Calkins, & Keane, 2010). However, parents of children with ADHD report significantly more parenting stress than parents of children without ADHD (Theule, Wiener, Jenkins, & Tannock, 2010). It seems more research regarding directionality of these effects is needed.

This current study has several shortcomings. Firstly, the sample size is too small with 43 participants, resulting in a low power which means that all results must be carefully interpreted. It is important that future research takes this into account and use a larger sample size. At the same time, based on the effect sizes, it is not expected that relationships that are not present in this current study will occur with larger sample sizes, as small effects do not tend to become significant with merely an increase in sample size.

Furthermore, the instruments used to measure the variables could be improved. Dutch translations of the IBQ and IBQS (Rocchi et al., 2017) were used: these turned out to be troublesome to interpret, as many children had questions when filling them in and the parents wrote in comments regarding the interpretability on the back of their forms. Whereas the internal consistency of the competence-support and competence-thwarting subscales were found to be acceptable according to three different studies in Rocchi’s (2017) article, in this current study the internal consistency for competence-thwarting (both IBQ and IBQS) was found to be poor and the internal consistency for competence-support (both IBQ and IBQS) was found to be unacceptable. This might be due to the translation from English to Dutch. Another criticism on the IBQ and IBQS, regarding both the original English and the translated Dutch versions, is that there are only four items per subscale which is a low number. In addition, as mentioned before, the go/no-go task was judged to be easy, resulting in a little variance in the resulting scores.

There are several suggestions to be made for future research. The first is to have, whenever possible, both parents of the child assess the level of ADHD symptoms in their child in order to procure a more accurate estimation. Also valuable to the research would be to
have the child him/herself complete a self-assessment questionnaire regarding their ADHD symptoms, especially considering this was done regarding competence-support and – thwarting. Another suggestion is to include the gender of the child: without any conclusive findings as of yet, it has been hypothesized that gender influences the parenting style concerning children with ADHD. Lastly, a measure of ADHD symptoms in not only the children but also their parents is suggested, as heritability is a factor in ADHD and might affect the parenting strategies used further. Longitudinal research is needed to determine how we can understand the relationship between competence-thwarting and ADHD symptoms.

In conclusion, the findings in this study indicate that competence-thwarting (as judged by parents) is negatively associated with ADHD symptoms in children. It is currently unknown if competence-thwarting is the cause of a higher level of ADHD symptoms, or whether it is the effect caused by a higher level of ADHD symptoms which in turn leads to the utilization of more negative parenting strategies. The supporting of competence does not appear to go together with lower ADHD symptoms: however, it is more beneficial for the children if their parents replace competence-thwarting parenting strategies with competence-supporting or competence-neutral strategies. No significant mediating role for self-control in the relationship between competence-support or competence-thwarting and ADHD symptoms was found.
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