The Relation Between Executive Function and Self-Regulated Learning in University Students with Attention Deficit Hyperactivity Disorder Symptomology

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Abstract

Objective: Do university students with ADHD-symptomology have less effective self-regulated learning (SRL) strategies, specifically cognitive strategies for learning, and to what extent does this relate to Executive Functions (EF)? **Method:** University students from Psychology participated (N = 160; age 18 and 35; M = 19,72; SD = 2,07). They completed the Connors' Adult ADHD Rating Scales (CAARS), Executive Function Index (EFI) and the long version of the Motivated Strategies for Learning Questionnaire (MSLQ). Data was analyzed using partial-correlation methods in SPSS. **Results:** EF decreases with ADHD-symptomology (r = -.51; p = <.001). Cognitive SRL strategies decrease with ADHD-symptomology (r = -.16, p = .03), with inattention being the strongest predictor of lower strategies (r = -0.18, p = .019). However, when controlling for EF the association disappears (r = .04, p =.59). EFI Total has a positive association with Cognitive SRL strategies (r = .35, p = <.001), with Strategic Planning (SP), Empathy (EM) and Motivational Drive (MD) being the strongest predictors (EFI SP: r = .36, p <.001; EFI EM: r = .34, p = <.001; EFI MD: r = .28, p = <.001). **Conclusion:** The study reveals that EF and Cognitive SRL strategies are less effective among university students with more ADHD-symptomology. The ADHD Inattentive symptoms have the strongest negative association with EF and SRL scores, while SP, EM and MD of EF have the strongest positive associations with Cognitive SRL strategies. Academic professionals can help increase academic achievements and well-being by improving SRL strategies.

Keywords: ADHD, Executive Functioning, Self-Regulated Learning, University Students.

The Relation Between Executive Function and Self-Regulated Learning in University Students with Attention Deficit Hyperactivity Disorder Symptomology

Attention-deficit/hyperactivity disorder (ADHD) is a developmental disorder seen in children and adults. ADHD in children is categorized into three subtypes: inattention, hyperactivity and impulsivity (American Psychiatric Association, 2013). ADHD is often associated with deficits in behavioral inhibition, sustained attention and resistance to distraction and regulation of one's activity level to the demands of a situation (Singh et al., 2015). There is growing evidence stating the heterogenicity of ADHD, meaning that the disorder comes with a variety of risk factors, neurocognitive deficits and co-existing disorders (Balázs & Keresztény, 2014; Fair et al., 2012; Luo et al., 2019). However, according to Dorr and Armstrong (2018), the symptoms of Attention-deficit/hyperactivity disorder (ADHD) in the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5; American Psychiatric Association [APA], 2013) are based on children and adolescents between four and 17 years of age. This forms a limitation to the diagnostics of adult ADHD. According to previous findings the main symptoms of adult ADHD are not conceptualized as three but two dimensions: inattention and inhibition (Barkley & Murphy, 2011; Fedele et al., 2010; Heidbreder, 2015; Murphy et al., 2001). One specific group of adults is university students. University students are an interesting focus group as they go through challenging stages in their life: transferring to different schools, moving houses and many more. Change requires challenging cognitive tasks including organization, planning activities, consider alternatives, monitor and reflect, metacognition, self-regulation, attention selection and time management (Eilam, 2003; Lyon & Krasnegoar, 1996; Metzler, 2007; Zimmerman, 1989).

ADHD-symptoms can influence these challenging tasks and people's daily life including impairments in social, academic and occupational performance. Murphy, et al. (2001) investigated executive functioning in young adults with ADHD-symptoms and young

adults without. They found a difference between the ADHD symptoms group and the control group regarding performance measures of inattention, interference control, response inhibition and nonverbal working memory. The ADHD group showed weaker performance than the control group which is supported by previous findings (Corbett and Stanczak 1999; Beck & Langberg, 2014; Boonstra et al., 2005; Dorr & Armstrong, 2018; Roy et al., 2017). Also, ADHD-symptomology in adults has been found to be at higher risk for lower level of educational and occupational performance, employment instability, antisocial behavior and substance abuse (Barkley et al., 1996; Weiss & Hechtman, 1993). According to Wolf, Simkowitz, and Carlson (2009) the subtype hyperactivity/impulsivity subgroup of ADHD seems to be more related to social problems and behavioral problems than the inattention subtype of ADHD. The inattention subtype seems to be more related to academic difficulties including increase academic concerns, lower Grade Point Average (GPA) and Scholastic Assessment Test (SAT) scores and decreased study skills (Frazer et al., 2007; Norwalk et al., 2009; Rabiner et al., 2008; Wolf et al., 2009).

Executive Functioning and ADHD

Many studies have suggested that ADHD is a heterogeneous disorder that is associated with multiple deficits (Balázs & Keresztény, 2014; Fair et al., 2012; Luo et al., 2019; Speerforck et al., 2019; Wu et al., 2022). Not only behavioural symptoms are associated with ADHD, but also cognitive dysfunctioning (Beck & Langberg, 2014; Boonstra et al., 2005; Dorr & Armstrong, 2018; Roy et al., 2017). One of the domains of cognitive functioning is executive functioning. Executive functioning (EF) is a set of cognitive processes necessary to control behaviour including planning, organizing, attention, focusing, memorizing and multitasking (Cristofori et al., 2019). In adult ADHD the deficits found in EF are mainly measures of response inhibition and working memory (Boonstra et al., 2005; Harvey et al., 2004; Harvey 2019).

Previous findings have reported a negative association between ADHD and EF (Becker & Langberg, 2014; Boonstra et al., 2005; Doyle, 2006). Task performance regarding planning, response inhibition, working memory, cognitive flexibility and set-shifting showed mainly deficits (Barkley, 2015; Jiménez-Figueroa et al., 2017; Nigg, 2006; Willcutt et al., 2005). According to empirical studies there is a high variability in EF found between individuals with ADHD-symptomology (Boonstra et al., 2005; Doyle, 2006; Heidbreder, 2015; Martinus et al., 2005). Not all individuals with ADHD-symptomology show impairment in EF (Doyle, 2006; Barkley et al., 2008; Jonsdottir et al., 2006; Stavro et al., 2007; Spinella, 2005). Deficits on EF tests may be weakly correlated to the severity of ADHD-symptomology (Barkley et al., 2008; Jonsdottir et al., 2006; Stavro et al., 2007). According to Barkley & Murphy (2011) and Spinella (2005), this disparity is largely due to the low ecological validity of the neuropsychological tasks of EF tests due to the complexity of the tests.

Furthermore, Kofler, et al. (2020) stated that EF questionnaire ratings consistently correlate non-significantly or weakly with performance-based EF tests. Therefore, stating that they cannot be used interchangeably as EF performance tests and rating scales test fundamental different underlying constructs (Kofler et al., 2020; Spiegel et al., 2017; Toplak et al., 2013). Performance tests are developed based on cognitive models of EF, while rating scales are bested on reflection on mental constructs involving success of goal pursuit and non-mental constructs (Spiegel et al., 2017). Barkley & Murphy (2010) found that the EF ratings of most ADHD adults were clinically impaired, but only a small minority showed impairments on the performance tests. The EF ratings were associated with deviant behavior like antisocial acts, crime diversity and negative driving outcomes. The neuropsychological EF tests were mostly unrelated to such behavior.

While research stays relatively contradictive about the topic of performance tests vs. rating scales, multiple studies did find that rating scales for EF predicted the functional outcomes better than the EF performance tests (Barkley & Murphy, 2010; Gioia et al., 2000; Gross et al., 2015; Kamradt et al., 2014; Mahone & Hoffman, 2007; Toplak, 2008). This current study will therefore focus on reliable rating scales to access the influence of EF and ADHD-symptomology in university students.

As mentioned earlier, university students are an extremely relevant and interesting focus group due to their life changing experiences which requires challenging cognitive tasks (Eilam, 2003; Lyon & Krasnegoar, 1996; Metzler, 2007; Zimmerman, 1989). According to previous literature, the ADHD-subtype Inattention seems to be more related to academic difficulties and increased academic concern (Frazer et al., 2007; Norwalk et al., 2009; Rabiner et al., 2008; Wolf et al., 2009). According to Pintrich (1995), self-regulated learning is a component of learning for college students that may have a positive impact on academics. Therefore, suggesting a relationship between SRL and academic performance. According to Pintrich (1995), students can learn to become self-regulated learners which is an important component of learning. This would mean that students with and without ADHD will be able to benefit from improving their self-regulated learning skills to improve academic performance.

Self-Regulated Learning and EF

The process by which learners plan and strategically guide their behaviors towards the achievement of self-set learning goals is called self-regulated learning (Lyon & Krasnegoar, 1996; Metzler, 2007; Zimmerman, 1989). Self-regulated learning has three components (Pintrich, 1995). First, self-regulated learners attempt to control behavior, cognition and motivation in such a manner that fits the demands of the situation. Second, the learner has a goal to accomplish. The learner can adjust behavior, cognition and motivation to positively

influence the performance in accomplishing the end goal. Third, the learner is in control, and not an external person like a caregiver or a teacher. Overall, self-regulated learning involves an active self-control that is goal-directed, controlling and changing motivational beliefs and adjusts cognitive strategies.

Studies suggest that EF and SRL have conceptual relations (Garner, 2010; Shelton et al., 2017). The analyses between the Executive Function Index (Spinella, 2005) and the Motivated Strategies for Learning Questionnaire (Pintrich et al., 1991) showed points of separation but also points of overlap (Garner, 2010). Specifically, EF of planning, motivational drive and impulse control were significant predictors of cognitive strategy use, academic effort regulation and metacognitive strategy. The affective and attributional components of SRL seemed to not correlate with EF.

The study of Shelton, et al. (2017) were the first to examine the relationship between Sluggish Cognitive Tempo (SCT) symptomatology and SRL and ADHD-symptomology. They found that among college students the inattentive symptoms of ADHD were a constant predictor of deficits in expectancy, use of value and self-regulated learning strategies. Overall, showing that SRL strategy use differs between college students with ADHD or SCT symptomatology with the inattentive symptoms being a constant predictor.

The question arises if students can be helped in developing their SRL strategies and if this would benefit their academic achievements. According to Field, et al. (2013) university students who received coaching services had significant higher academic achievements and higher well-being, than students in the comparison group. Coaching seemed to be highly important in learning.

Present Study's Research Question and Hypotheses

Using a dimensional approach, the relationship between ADHD symptoms and SRL and the role of EF in this relationship will be investigated. An analysis will be conducted with

non-clinical university students from Groningen. A visual representation can be found in Figure 1 of Appendix A. Online questionnaires will be used, including the EFI (Spinella, 2005), MSLQ (Pintrich et al., 1993) and CAARS (Connors, 1998). The research question of this study is: 'Do university students with ADHD-symptomology have less effective self-regulated learning (SRL) strategies, specifically cognitive strategies for learning, and to what extent does this relate to Executive Functions (EF)?'. Previous findings have reported a negative association between ADHD and EF (Becker & Langberg, 2014; Boonstra et al., 2005; Doyle, 2006). According to Garner (2010) the domains of EF: planning, motivational drive and impulse control are significant predictors for cognitive strategy use of SRL. Therefore, this current study hypothesizes a negative correlation between ADHD-symptomology and EF total. Secondly, a negative association between ADHD-symptomology and SRL is expected, predicting that the subtype Inattentive is a stronger predictor for lower SRL than Hyperactive/impulsive, which supports Shelton, et al. (2017)'s findings. Thirdly, a positive association will be expected between the domains: planning, motivational drive and impulse control of EF with SRL.

Method

Participants

A group of first year students from the Psychology program of the University of Groningen, The Netherlands, were recruited for the study. This study consisted of two surveys which were administered at two separate times. Only participants who completed both questionnaires at both times were included in the analysis. In the first part of the study, 303 people participated. Of this group, 257 people also participated in the second part of the study. Altogether, 97 participants that participated in both surveys were removed from the analysis. The following criteria were used as exclusion: participants under the age of 17, participants who did not identify as either man or women, participants that did not complete

both surveys and participants who failed the check-up questions in reliability. Additionally, data was excluded using the cut-off scores of the Infrequency and Inconsistency Index.

The final sample consisted of 160 participants with ages ranging from 18 years to 35 years old *(M* = 19.72; *SD* = 2.07). When looking at biological sex, 128 were women and 32 were man (Man = 1, Women = 2; *M* = 1.8, *SD* =.4). Most of the sample consists of European members with the majority being Dutch citizens.

All the participants for this study were recruited through SONA. This is an online research platform where students can participate in scientific research in exchange for credits, as part of a course. To participate students had to be enrolled in the course 'Introduction to Psychology', a first-year mandatory course. If participants give consent to look up their grades, the data will be used in future studies analyzing student performance. Before participating, all participants were informed of their rights, confidentiality of their data and were given an outline of the study. They were then asked for their consent, based on this information. Before recruitment took place, the study was approved by the Ethics Committee of the Psychology Department of the University of Groningen (PSY-2021-S-0054).

Research design and procedure

The present study has a correlational design and investigates connections between levels of ADHD symptoms, EF and cognitive SRL strategies through the use of quantitative analysis methods. No predictions about the causality of associations were made, only defining variables as independent and dependent in the context of performing a regression analysis. A correlational analysis was chosen in order to reflect on the dimensional nature of the studied variables. This approach allowed us to analyze the differences in the strength of association between ADHD, EF and different cognitive SRL strategies in a more nuanced way and is further relevant because of our use of a non-clinical sample.

Data was collected through the online questionnaire platform Qualtrics, which participants were redirected to after signing up for the study through SONA, using their university login information. As mentioned before, only participants who completed a previous survey regarding the level of ADHD symptoms they experienced, were recruited for our study. They also must have participated in the "Introduction to Psychology" course and have sufficient command of the English language. Later participants younger than 18 years old, participants that did not identify as women or man and participants who failed the check-up questions and participants scoring above the cut-off score for the Infrequency Index and Inconsistency Index were excluded from the study. Apart from this, no further exclusion criteria were defined.

Participants were redirected to Qualtrics, where they completed multiple surveys measuring their EF and asking them about the learning strategies they typically employ while studying. Jointly, the two surveys consisted of the CAARS, EFI, and MSLQ questionnaires (see Measures). The total time needed to complete the first survey is approximately 60 minutes and the second survey approximately 40 minutes, which makes a total of 100minutes. Participants are compensated with SONA credits for their participation. The study was available on SONA from the 25th of January 2023 until the 14th of February 2023. Participants were free to sign up for and complete the study at any time within this period.

Measures

CAARS

The Conners' Adult ADHD Rating Scales (CAARS) was used to measure the ADHD-symptoms. The CAARS is a self-rating scale intended for adults aged 18 and up who present with ADHD-symptoms (Conners et al., 1998). It makes use of a four-point Likert scale (0 = never; 1 = occasional; 2 = often; 3 = very often). The CAARS consists of two types of forms, a self-report rating and an observer rating. For this study the long version of the self-report

CAARS (CAARS-S:L) was used. This list consists of 66 items which represent nine different subscales. The long form of the CAARS will take most adults approximately less than 30 minutes.

Four of these subscales test for the behavioral symptoms of ADHD: 1. Inattention/Memory Problems (12-item); 2. Hyperactivity/Restlessness (12-item); 3. Impulsivity/Emotional Lability (12-item); 4. self-concept problems (6-item). For the subscale Inattention/Memory Problems examples of questions are: “I don’t plan ahead.” and “I can’t get things done unless there’s an absolute deadline.”. Examples of questions for the subscale Hyperactivity/Restlessness are: “I like to be doing active things.” and “I can’t sit still for very long.”. Examples of questions from the subscale Impulsivity/Emotional Lability are: “I blurt out things” and “My moods are unpredictable.”. For the subscale problems with Self-Concept example questions are: “I get down on myself.” and “I wish I had greater confidence in my abilities.”. The remaining three scales measure ADHD-symptomatology in keeping with the guidelines of the Diagnostic and Statistical Manual of Mental Disorders (APA, 1994): DSM-IV Inattention Symptoms subscale (9-item), DSM-IV Hyperactivity-Impulsivity symptoms subscale (9-item) and the DSM-IV ADHD-symptoms total scale. To report on the total degree of adult ADHD-symptomatology and to assess an individual’s overall risk of being diagnosed with ADHD (Mohamed et al., 2016), the questionnaire uses the ADHD index subscale (12-item). Example questions of the DSM-IV Inattentive Symptoms list are: “I lose things necessary for tasks or activities.” and “I don’t like homework or job activities where I have to think a lot.”. Example questions from the DSM-IV Hyperactive-Impulsive Symptoms are: “I talk too much.” and “I am restless or overactive.”. For the ADHD Index the following questions are examples of questions included: “I am always on the go, as if driven by a motor.” and “I can’t keep my mind on something unless it’s really interesting.”.

The total score of the CAARS varies between 0 and 198. For the analysis, the raw scores of the CAARS subscales first have to be converted into T-scores, a standard score with a mean of 50 and a standard deviation of 10 across all scales in every sample. Using T-scores help to compare subscale results. The correct gender and age category column were used.

The CAARS manual dictates that a T-score of 65 or higher fall into the clinically significant range and therefore signals an above average representation of ADHD-symptomatology in an individual (Conners et al., 1998). When the T-score is below 60, it often indicates no ADHD-symptomology. A T-score above 80 can be a possible indicator of invalidity because of exaggeration or malingering of symptoms (Conners et al., 1998; Suhr et al., 2011). Overall, the higher the T-score, the higher the presented ADHD-symptomatology.

This study has found a Cronbach's alpha of .96. Other studies have found the alpha of the CAARS self-report measures to fall in between .66 and .90 (Conners et al., 1998). The CAARS questionnaire has shown to have a good internal consistency, acceptable test-retest reliability and holds a high sensitivity towards distinguishing between healthy control groups and individuals diagnosed with ADHD (Christiansen et al., 2012; Erhard et al., 1999). The Total Infrequency Index (CII) for the CAARS-S-L, created to detect possible feigning, has a Cronbach's alpha of .86. The cut-off score for the Infrequency Index used for the present study was everything above a score of 20. The CII has a general modest sensitivity (30%) and a high specificity (95%) (Wallace & Walls, 2020). Additionally, we used the Inconsistency Index, created to detect careless and random responding. The Inconsistency Index was used to identify the internal and external consistency in item response patterns by comparing the response pattern of individuals of the same age and sex (CAARS; Connors et al., 1998). The cut-off score for the Inconsistency Index (INC) was everything under the score of eight. According to Wallace & Walls (2020), the INC had a moderate sensitivity (40%) and a high specificity (91%).

Generally, the DSM Total score is used to assess children or young adults while the total ADHD Index is used for adults. Due to our sample consisting out of young adults, we used the DSM Total score for this study.

MSLQ

The Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, 1991) is a self-report scale used to assess academic motivation and the different learning strategies in university students. This scale consists of two sections: Motivation scales and Learning Strategies scales, which cover 15 different subscales (Intrinsic Goal Orientation, Extrinsic Goal Orientation, Task Value, Control of Learning Beliefs, Self-Efficacy for Learning and Performance, Test Anxiety, Rehearsal, Elaboration, Organization, Critical Thinking, Metacognitive Self-Regulation, Time and Study Environment, Effort Regulation, Peer Learning and Help Seeking). They are assessed using a seven-point Likert response option format (from 1 = not at all true of me to 7 = very true of me).

The first section assesses motivation with 31 items and asks for goals-value beliefs, control beliefs and self-efficacy. The second section assesses learning strategies includes 31 items to assess different cognitive and metacognitive strategies. This part further includes 19 items to assess for resource management. Examples of questions from the Motivation scale are: “In a class like this, I prefer course material that really challenges me so I can learn new things.” and “Getting a good grade in this class is the most satisfying thing for me right now.”. Examples of questions from the Learning Strategies scales are: “When I study for this class, I practice saying that material to myself over and over.” and “When I study for this class, I pull together information from different sources, such as lectures, readings, and discussions.”. Overall, the entire questionnaire takes about 20-30 minutes for completion but it is possible to only administer individual subscales for assessment.

Scales for the MSLQ are constructed by taking the mean of the items making up that scale. The score will be computed by summing up the items and taking the average. The score of the "reversed" items have to be reversed. For example, an individual scoring a 1 on an item now receives a 7. A higher score like 4, 5, 6, and 7 is better than a lower score like 1, 2, or 3. Exception is the Anxiety scale where a higher score is more worrying. In general, except for the Anxiety scale, if the scores are above 3, the individual is doing well. If the score is below 3, help may be needed from instructors or services at the institution.

Past research has reported the alpha of the MSLQ to fall in between .52 and .93 (Pintrich et al., 1993). This study has found a Cronbach's alpha of .89 for the entire MSLQ. The MSLQ has so far demonstrated a good reliability of its subscales, as well as reasonably good predictive validity of performance (Pintrich et al., 1993). Given the sample characteristics, the MSLQ is an appropriate and well fit research tool (Davenport, 2003).

Take note, for this present study we only focused on the cognitive and metacognitive strategy scales of the MSLQ. Hypothesizing the relationship between the SRL Cognitive and Metacognitive strategies, EF and ADHD.

EFI

The Executive Function Index Scale (EFI; Spinella, 2005) is a self-assessment scale to measure executive functions used in daily life (Mohamed et al., 2021). It utilizes a five-point Likert scale response format (1 = not at all, to 5 = very much) for 27 items. Those items are representative of five subscales: motivational drive (motivation, energy levels), organization (multitasking, sequencing), impulse control (self-inhibition, propensity for risky behaviour), empathy (interest in the well-being of others, pro-social behaviour), and strategic planning (planning, thinking ahead, making use of strategies) (Spinella, 2005). Questions for this scale include, for example: "I save money on a regular basis" or "I think about the consequences of an action before I do it".

The total score of the EFI is calculated using the sum of all items. Here, a lower score is indicative of poorer EF. With an increase in score, the EF improves as well (Spinella, 2005). For this present study all of the subscales of the EFI were analyzed with their relationship to cognitive SRL strategies.

Different studies have reported the internal consistency to be acceptable (Spinella, 2005; Gwenny et al., 2009). Originally, the reported alpha for the EFI scale falls in between .70 to .82 (Spinella, 2005). In comparison, this study reports a Cronbach's alpha of .75.

Data Analysis

After extracting the raw data from the Qualtrics software and the exclusion criteria procedure, results from the CAARS, EFI, and MSLQ were analyzed. Descriptive statistics were obtained for our data, see Table 1. We conducted assumption checks to assess the validity of the data, descriptions of which can be found in the appendix. Due to high multicollinearity we decided to part from our multiple regression analysis and choose for a partial correlation approach. We extracted three variables from our data based on their respective measures, namely; EF levels, ADHD levels, and SRL strategies.

In order to assess the first hypothesis, a simple bivariate correlation was used to evaluate the relationship between ADHD and EF. To assess the second hypothesis, a correlation matrix was used and partial correlation analysis was conducted. To evaluate the difference between the symptoms of the ADHD symptoms, partial correlations were conducted controlling for the other ADHD symptoms. To test the third hypothesis, partial correlations were performed between ADHD-symptomology and cognitive SRL strategies, controlling for every EF level separately. The correlational values of these two analyses are then compared to deduce the influence the inclusion of EF has on the association between ADHD and SRL.

Results

Descriptive Statistics

The descriptive statistics can be found in Table 1.

Table 1

Descriptive statistics of the ADHD subgroups, Executive Functioning subscales and the Cognitive SRL strategies subgroup. The sample consists of N=160.

	Min	Max	Mean	SD	Variance
	Statistic	Statistic	Statistic	Statistic	Statistic
CAARS Inattention	34.63	83.65	54.20	10.83	117.38
CAARS HypImp	34.59	83.74	50.66	8.65	74.98
CAARS Total	33.75	79.62	52.66	9.38	88.15
EFI_ORG	5.00	23.00	15.10	3.38	11.46
EFI_SP	14.00	34.00	23.95	4.16	17.35
EFI_IC	9.00	23.00	16.71	3.01	9.07
EFI_EM	15.00	30.00	25.65	3.40	11.58
EFI_MD	8.00	20.00	14.19	2.91	8.47
EFI_total	72.00	121.00	95.63	9.89	97.95
MSLQ_COG	2.45	6.62	4.48	.79	.62

Note: CAARS: Connors' Adult ADHD Rating Scales; ORG: organization; SP: strategic planning; IC: impulse control; EM: empathy; MD: motivational drive; MSLQ: Motivated Strategies for Learning Questionnaire; COG: cognitive; Std.D: standard deviation; HypImp: subgroup hyperactive/impulsive from ADHD; DSM: diagnostic and statistical manual of mental disorders; Min: minimum; Max: maximum; SD: standard deviation.

Hypothesis 1: EF and ADHD-symptomology

The first hypothesis: ADHD-symptomology reduces the performance of EF, was tested using a simple bivariate correlation. Results can be found in Table 2 in Appendix C. A

significant negative correlation was found between the CAARS DSM Total and the EFI Total (r = -.51) with a p-value of <.001, supporting the first hypothesis.

To investigate the difference between the symptom domains of ADHD and EF, a partial correlation was performed. No significant partial correlation was found between the CAARS DSM Hyperactive/Impulsive symptoms and the EFI total, controlling for CAARS DSM Inattention (r = -.05, p = .50). When performing a partial correlation between the CAARS DSM Inattentive symptoms and the EFI total, controlling for CAARS DSM Hyperactive/Impulsive, a medium significant negative correlation was found (r = -.43, p = <.001). These results show that the deceased EF performance due to ADHD-symptomology relates more to the Inattentive subtype, rather than the Hyperactive/Impulsive symptoms of ADHD.

Hypothesis 2

ADHD-symptomology and Cognitive SRL Strategies

The second hypothesis is: ADHD-symptomology reduces the performance of SRL with the inattentive symptoms being a stronger predictor for cognitive SRL strategies than the hyperactive/impulsive symptoms. This hypothesis was tested using the correlation matrix, see Table 2 in Appendix C. A small significant negative correlation was found between the CAARS Total and the Cognitive SRL Strategies (r = -.16, p = .036). Looking closer into the symptom domains of ADHD a stronger significant negative correlation was found between the CAARS DSM Inattention and the Cognitive SRL Strategies (r = -0.18, p = .019) than with Hyperactivity/Impulsivity, which did not show a significant result (r = -0.09, p = 0.241), which supports the second hypothesis.

To investigate the association between the Cognitive SRL Strategies and the CAARS Inattentive symptoms, while taking the effect of the CAARS Hyperactive/Impulsive away, a partial correlation was conducted, see Table 3 for the partial correlations. A small significant

negative correlation was found (r = -.16, p =.04), see Table 3. When controlling for CAARS Inattentive on the association between the CAARS Hyperactive/Impulsive and the Cognitive SRL Strategies, a non-significant small positive result was found (r = .02, p = .76). These findings are still supporting the second hypothesis which suggests that the Inattentive symptoms of ADHD predict the Cognitive SRL Strategies more than the Hyperactive/Impulsive symptoms.

Table 3

Partial Correlations with MSLQ COG

	Control Variable	MSLQ COG
CAARS Inattention	CAARS HypImp	-.16*
CAARS HypImp	CAARS Inattentive	.02
CAARS Total	EFI Total	.04
CAARS HypImp	EFI Total	.05
CAARS Inattention	EFI Total	.03
EFI Total	CAARS Total	.35**
EFI SP	CAARS Total	.33**
EFI EM	CAARS Total	.33**
EFI MD	CAARS Total	.29**
EFI ORG	CAARS Total	-.02
EFI IC	CAARS Total	-.07

Note: CAARS: Conners' Adult ADHD Rating Scales Self-Report; ORG: organization; SP: strategic planning; IC: impulse control; EM: empathy; MD: motivational drive; MSLQ: Motivated Strategies for Learning Questionnaire; COG: cognitive; Std.D: standard deviation; HypImp: subgroup hyperactive/impulsive from ADHD, **p < .01 level, *p: <.05.

Cognitive SRL Strategies, EF and ADHD

To test the influence of EF on the association between ADHD-symptomology and Cognitive SRL strategies, a partial correlation analysis was conducted. A small non-

significant positive correlation was found between the CAARS Total and MSLQ, controlling for EFI Total (r = .04, p =.59). Also, a nonsignificant partial correlation was found between the CAARS DSM Hyperactive/Impulsive and the MSLQ Cognitive, controlling for EFI Total (r = .05, p = .49). Neither was there a significant partial correlation between the CAARS DSM Inattention and the MSLQ Cognitive, controlling for EFI Total (r = .03, p = .69). The results show no significant relationship between the cognitive SRL strategies and ADHD symptomology when controlling for EF. These results do not support the first part of the second hypothesis, which expected ADHD-symptomology to have a negative effect on SRL.

Hypothesis 3: EF subscales and Cognitive SRL Strategies

The third hypothesis is: a more efficient EF has a positive influence on Cognitive SRL strategies, with the subscales Strategic Planning, Motivational Drive and Impulse Control of EF being the significant predictors. First the correlation matrix was analyzed to evaluate the correlations between the EFI (subscales) and the MSLQ. Results can be found in Table 2 of Appendix C. Overall, a significant positive correlation was found between EFI Total and MSLQ Cognitive (r = .38, p = <.001). When looking closer into the EFI subscales the strongest significant correlations were found between the MSLQ Cognitive and EFI SP (r = .36, p <.001), EFI EM (r = .34, p = <.001) and EFI MD (r = .28, p = <.001) supporting the hypothesis partially. The correlation between EFI's Impulse Control and Organization with MSLQ Cognitive were not significant (EFI IC: r = .006, p = .93; EFI ORG: r = .07, p = .34).

To test the influence of CAARS Total on the association between de MSLQ Cognitive and the EFI Total, a partial correlation was conducted. Results can be found in Table 3. Still a significant positive result was found between the EFI Total and the MSLQ Cognitive, when controlling for CAARS Total. Additionally, partial correlations were performed for every subscale of the EFI. EFI's Strategic Planning, Empathy and Motivational Drive have a significant positive correlation with Cognitive SRL strategies. EFI's Organization and

Impulse Control had very small non-significant negative correlations with Cognitive SRL strategies.

Discussion

The current study investigated the relationship between executive functioning and cognitive self-regulated learning strategies in university students, taking a dimensional approach in the analysis of ADHD symptomology. The following research questions were investigated: Do university students with ADHD-symptomology have less effective SRL strategies, specifically cognitive strategies for learning, and to what extent does this relate to EF? Additionally, we looked closer into the differences between the ADHD symptom domains and the domains of EF.

It was first hypothesized that ADHD-symptomology decreases EF performance. The results were consistent with this hypothesis, which was in line with previous literature which used questionnaire ratings of EF (Beck & Langberg, 2014; Boonstra et al., 2005; Corbett & Stanczak 1999; Dorr & Armstrong 2018, Doyle, 2006; Harvey et al., 2004; Harvey 2019; Murphy et al, 2001; Roy et al., 2017). University students with more ADHD symptomology report having difficulties with attention regulation, organizing and managing behavior, scoring high on the EFI items like “I start things, but then lose interest and do something else”, “When doing multiple things in a row, I mix up the sequence.” and “I sometimes lose track of what I’m doing”. These EF difficulties may affect learning strategies in academics. Therefore, we tested our second hypothesis to investigate the effect of EF on cognitive SRL strategies, as it may influence academic performance.

Regarding the second hypothesis, we expected a higher score on ADHD-symptomology to relate to lower effectiveness of Cognitive SRL strategies, with the Inattentive symptoms being a stronger predictor for Cognitive SRL strategies than the Hyperactive/Impulsive symptoms. Results were consistent with this hypothesis, which is in

line with the findings of Shelton, et al. (2017). However, when focusing on the Hyperactivity/Impulsivity symptoms, our findings did not match with the results of Shelton, et al. (2019). Their results suggested that the Hyperactivity/Impulsivity symptoms of ADHD could be a compensatory factor in the decreased effectiveness of SRL (Shelton et al., 2019). This present study did not find any supporting evidence for an association between the Hyperactivity/Impulsivity symptoms of ADHD and EFI Total. Note that the statistical analysis used in Shelton, et al (2019) is rather doubtful due to the high correlations between predictors in the regression analysis. Due to multicollinearity the predictors each provide less information. This is because most of the information might already be provided by another predictor. Therefore, it is doubtful whether Hyperactivity/Impulsivity symptoms of ADHD plays a role in SRL strategies.

One important and interestingly finding of this study is the influence of executive functioning on the relationship between inattentive ADHD-symptomology and Cognitive SRL Strategies. As mentioned before, when analyzing the relation between Cognitive SRL strategies and ADHD-symptomology, when controlling for executive functioning, we find no significant relation. It seems like the relationship between ADHD-symptomology and Cognitive SRL strategies is influenced by executive functioning. As executive functioning is strongly related to ADHD-symptomology, executive functioning seems a better explanatory factor in ADHD-symptomology than SRL. To investigate the relationship between executive functioning and SRL further, the third hypothesis was tested.

Looking closer into the third hypothesis, it was hypothesized that a more efficient EF has a positive influence on Cognitive SRL strategies, with the subscales Strategic Planning, Motivational Drive and Impulse Control of EF being the significant predictors. This hypothesis was partially supported by the results. A significant positive correlation was found between executive functioning and the cognitive self-regulation learning strategies (r = .38, p

= <.001). When focusing on the executive functioning subscales the strongest significant correlations were found between the Cognitive SRL strategies and the Strategic Planning (r = .36, p <.001), Motivational Drive (r = .28, p = <.001) and Empathy of executive functioning (r = .34, p = <.001).

These results are partially contradicting and partially replicating the findings of Garner (2010). According to Garner (2010), The EFI questionnaire from Spinella (2005) shows separation but also overlapping points with the MSLQ of Pintrich, et al. (1991) with the EFI subscales Strategic Planning, Motivational Drive and Impulse Control being the most significant predictors of the MSLQ Cognitive components (Garner, 2010). However, the correlation between Impulse Control and Organization of executive functioning with the Cognitive SRL strategies, were not significant in the present study (EFI IC: r = .006, p = .93; EFI ORG: r = .07, p = .34). A factor contributing to these findings could be our sample group. Due to the fact that this present study only included psychology students from the University of Groningen, it is possible that Empathy has a stronger relationship with SRL in this specific sample.

Research indicates that highly empathic students are more likely to choose a degree in psychology (Aleksandar et al., 2011; Groen et al. (2017); Lyons, 2003; Putrino et al., 2021). Groen, et al. (2017) conducted an empirical study analysing the differences in Empathizing-Systemizing cognitive style (E-S) between sexes, explaining the underrepresentation of women students in the physical sciences and the underrepresentation of man in the social sciences. The physical science students scored lower on empathy quotient (EQ), measuring empathy, than the social science students. This result was regardless of sex. Therefore, the relationship between empathy and choosing a social science course might influence the present study results. For achieving more generalizable findings, future research should include a variety of students from different faculties.

Coming back to the main message of this present study: the relationship between ADHD-symptomology and Cognitive SRL Strategies seems to be influenced by executive functioning, with the strongest predictors being Strategic Planning, Motivational Drive and Empathy of the EFI. It seems like executive functioning is a better predictor of the cognitive aspects of self-regulated learning than ADHD symptomology.

Strengths

The first strength of this study is its uniqueness investigating the relationship between ADHD-symptomology, SRL and the EF subscales. This study is the first to examine one of the subscales of the MSLQ (cognitive and metacognitive) and its relation to ADHD-symptomology from both the inattentive and hyperactive/impulsive symptoms and the different subscales of EF. Future research could elaborate on other subscales of the MSLQ and its relations with ADHD and EF to broaden knowledge about specific aspects of the learning strategies. The more information we gain, the more specific a treatment can be created, the more effective our educational system can be.

Another strength of the present study is its dimensional approach to ADHD-symptomology. Therefore, these findings can be useful in clinical and academic environment. Due to the dimensional approach, clinicians have more latitude to assess behaviour without being limited nor focused on a categorical approach. They do not need a concrete threshold between a disorder and being “normal” to help clients. This gives more room to open interpretation of neuropsychological profiles, being able to adapt treatment more to one’s individual needs. This adds great value to the present study. Another strength of the dimensional approach is that statistical power increases due to the use of larger sample sizes compared to a clinical sample. Additionally, due to the dimensional approach there is less interference of medication use and comorbid disorders, which occurs more within a clinical sample.

Furthermore, this study design is a very cost-effective way of performing scientific research. Using online questionnaires is an excellent way to gather valuable information from many people in a short period of time. Participants can execute the instructions easily at home or at other preferred settings with only a computer and internet needed. Additionally, a survey study is relatively easy to replicate as the questionnaires are standardized which increase reliability. This brings us to the next strength of this study which is that we only used validated questionnaires to analyze the constructs. Additionally, we checked for noncredible data using the infrequency and inconsistency index. Only seriously answered questionnaires were included in the study. Therefore, the measures are validated and reliable.

Weaknesses

Several limitations were noticed in this present study. The first point of critic is regarding the sample used. As mentioned previously, only university students from Psychology, University of Groningen, were included in this study making the results less generalizable to the entire student population. This decreases external validity. However, the results can be more applicable to social studies rather than other studies including physical studies, due to the role of empathy in choosing a study course. To increase external validity, university students from all around the Netherlands or even all around the world could be included in a sample. Furthermore, not only psychology students but students from different faculties could be included, keeping in mind a representational distribution regarding demographics.

Another weakness is that there were only 32 men included in our sample group of 160 participants. Previous literature found that gender might play a role in the influence of ADHD on a person. Girls with ADHD are more likely to have symptoms from the inattentive subtype of ADHD, while boys suffer more from the hyperactive-impulsive symptoms of ADHD (Biederman et al., 2002; Levy et al., 2005; Slobodin & Davidovitch, 2019). To gain

more understanding of ADHD symptomology in man and women, a more balanced sample should be used.

Another weakness of this study is that multiple statistical analysis was conducted on one dataset. This may amplify the probability of a false positive outcome. The question arises if some of the results are due to chance. However, when performing a post-hoc Bonferroni test to reduce the instance of false positives, the alpha of 0.05 was divided by the number of statistical analyses performed. The significant results stayed significant after performing the correction which did not jeopardize the study results and the chosen analysis. However, in future research this should be avoided and researchers can decide to focus on one single analysis per dataset for decreasing the risk of false positive outcomes (e.g. mediation analysis or structural equation modelling).

It should be noted that there is a mandatory course in the first year of Psychology at the University of Groningen, which is called “Academical Skills”. During the course, students reflect on their expectations and goals during their academic carrier. The exercises and assignments they have to complete, might have influenced the students SRL strategies. However, this should not be a methodological problem as all participants might have followed the course, as it’s included in the first year of the Psychology course.

Clinical Implications

Previous studies suggested that the Inattention symptoms of ADHD have a stronger relation with difficulties in academical fields (Frazer et al., 2007; Norwalk et al., 2009; Rabiner et al., 2008; Wolf et al., 2009). As SRL is a component of learning, our results suggest that SRL strategies will be less effective in students with higher inattentive ADHD-symptomology, mainly due to the areas of executive functioning playing a role in the relationship between SRL and inattentive ADHD-symptomology. Universities or healthcare professionals can offer support to increase SRL strategies which would likely lead to

increased academic achievements. This will mainly be in students with less effective executive functions. Teaching students more effective SRL strategies will benefit all students, and it may particularly benefit students with inattentive ADHD-symptomology. According to previous findings SRL is improvable which Universities could take advantage of (Schunk, 2005; Wolters, 2010; Zusho & Edwards, 2011).

According to Paris & Paris (2010), examples of SRL are provided for three areas of research: reading and writing, cognitive engagement in tasks and self-assessment. The use of informative material, repeated conversations over clinical visits using metacognitive discussions and self-monitoring strategies, peer tutoring and self-reinforcement can all help increase a student's effectiveness in learning strategies (Paris & Paris, 2010; Reid et al., 2005; Tamayo-Velázquez et al., 2010; Weinstein et al., 2000). Teachers can create a save and open classroom environment where students can reflect on their own learning strategies and on the learning strategies of other students. They may be able to learn from each other and experience the effectiveness of different management styles. Additionally, students can reflect on their goals and motivation, gaining more insight and knowledge into their behavior and learning how to influence their own behavior towards achieving one's goals. This will lead to a positive influence on academic performance. According to Reid, et al. (2005) reviews of self-regulation literature were positive on the effects of SRL techniques. However, many studies are performed on children therefore future studies could focus on university students in particular with ADHD-symptomology.

Conclusion

The present study reveals that executive functioning and Cognitive SRL strategies are less effective among university students scoring higher on ADHD-symptomology. The ADHD Inattentive symptoms have the strongest association with executive functioning and Cognitive SRL scores. It should be noted that the relationship between inattentive ADHD

symptomology and Cognitive SRL Strategies seems to be influenced by executive functioning, with the strongest predictors being Strategic Planning, Motivational Drive and Empathy of the EFI. The present study did not support previous suggestions that Hyperactive/Impulsive symptoms may compensate for lower scores on SRL.

Future research could replicate the findings using a diverse sample group including students from different faculties and countries while including both man and women. Additionally, more advanced statistical analyses should be performed on the sample, limiting the risk of false positive outcomes. Additionally, future research could elaborate on the other subscales of the MSLQ and its influence on ADHD-symptomology using a dimensional approach.

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Appendix A

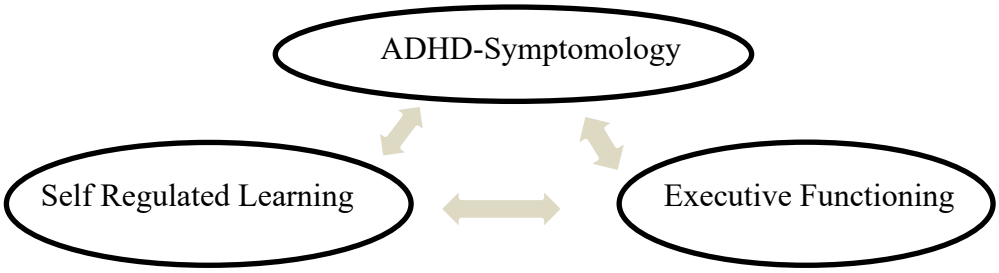

Figure 1 A graphical illustration of the investigated relationship between EF, SRL and ADHD symptoms.

Appendix B

Assumptions

First, data was analyzed for outliers. The statistical software platform SPSS was used to generate box plots to visualize outliers. Results can be found in Figure 2 of the Appendices. The CAARS DSM Total, CAARS DSM Hyperactive/Impulsive and the MSLQ Cognitive boxplots showed one outlier while all EFI boxplots showed no outliers. The decision was made to not exclude any outliers to increase variability in the data. Additionally, keeping the outliers would be more suitable for a dimensional approach. Additionally, no strong arguments could be found to exclude them from the sample.

Second, linearity was checked using a scatterplot to make a visual representation. Results can be found in Figure 3. All scatterplots don't show deviation in linearity, meeting the assumption. The scatterplot of the CAARS Total and EFI Total show a negative relationship, while the MSLQ Cognitive and EFI Total or EFI Strategic Planning show a positive relationship. This relationship will be further evaluated later in this paper.

Third, the normality assumption was checked by investigating the skewness, kurtosis, Shapiro-Wilk and a QQ-plot. First a normality test was performed in SPSS. Results can be found in Table 5.

Table 5

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
CAARS Inattent	.12	160	<.001	.96	160	<.001
CAARS HypImp	.13	160	<.001	.95	160	<.001
CAARS Total	.11	160	<.001	.95	160	<.001
EFI ORG	.10	160	<.001	.98	160	.080
EFI SP	.07	160	.034	.98	160	.133

EFI IC	.14	160	<.001	.96	160	<.001
EFI EM	.13	160	<.001	.91	160	<.001
EFI MD	.11	160	<.001	.96	160	<.001
EFI Total	.06	160	.200*	.99	160	.44
MSLQ COG	.04	160	.200*	.99	160	.74

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Note: This table presents the normality tests of the ADHD subgroups, Executive Functioning subgroups and the Cognitive SRL strategies. ORG: organization; SP: strategic planning; IC: impulse control; EM: empathy; MD: motivational drive; Inattent: subgroup inattention from ADHD; MSLQ: Motivated Strategies for Learning Questionnaire; COG: cognitive; HypImp: subgroup hyperactive/impulsive from ADHD, **p < .01 level, *p: <.05.

For the variables MSLQ Cognitive, EFI SP, EFI ORG and EFI Total the Shapiro-Wilk test shows no deviation from normality, see Table 6. However, the CAARS DSM Total, CAARS DSM Inattentive, CAARS DSM Hyperactive/Impulsive, EFI IC, EFI EM and EFI MD did deviate (p = <.001). Investigating the skewness and kurtosis all the values lay between -1 and 1, indicating that the deviation was mild. Additionally, a visual inspection with the help of a QQ-plot, seemed not to deviate from normal. Therefore, the decision was made to continue with the analysis. However, this should be noted during the interpretation of the analysis.

Table 6

Skewness and Kurtosis

	Skewness		Kurtosis	
	Statistic	Std. Error	Statistic	Std. Error
CAARS Inattention	.54	.19	-.40	.38
CAARS HypImp	.80	.19	.66	.38
CAARS Total	.58	.19	-.38	.38
EFI_ORG	-.25	.19	.14	.38
EFI_SP	.06	.19	-.57	.38
EFI_IC	-.47	.19	.02	.38
EFI_EM	-.94	.19	.54	.38
EFI_MD	-.07	.19	-.87	.38
EFI_total	-.07	.19	-.25	.38
MSLQ_COG	-.10	.19	-.11	.38

Note*:* This table presents the Skewness and Kurtosis of the ADHD subgroups, Executive Functioning subgroups and the Cognitive SRL strategies. ORG: organization; SP: strategic planning; IC: impulse control; EM: empathy; MD: motivational drive; MSLQ: Motivated Strategies for Learning Questionnaire; COG: cognitive; HypImp: subgroup hyperactive/impulsive from ADHD; Std. Error: standard error.

Furthermore, a correlation matrix was generated. Results can be found in Table 2 of Appendix C. CAARS DSM Inattention correlated relatively strong with CAARS DSM Hyperactive/Impulsive (r = .602, p = <.001), the EFI ORG (r = -.627, p = <.001), the EFI SP (r = -.418, p = <.001) and the EFI Total (r = -.546, p = <.001). The CAARS Hyperactive/Impulsive correlated relatively strongly with the EFI ORG (r = -.410, p = <.001) and the EFI IC (r = 0.477, p = <.001).

To examine multicollinearity the VIF was inspected. Results can be found in Table 7. All VIF are between 1 and 2 which indicates low multicollinearity. Therefore, a partial correlation analysis was chosen to investigate the hypothesis further.

The assumption for homoscedasticity was checked using a scatterplot of residuals. No specific pattern in residuals was noted concluding that the assumption for homoscedasticity was met.

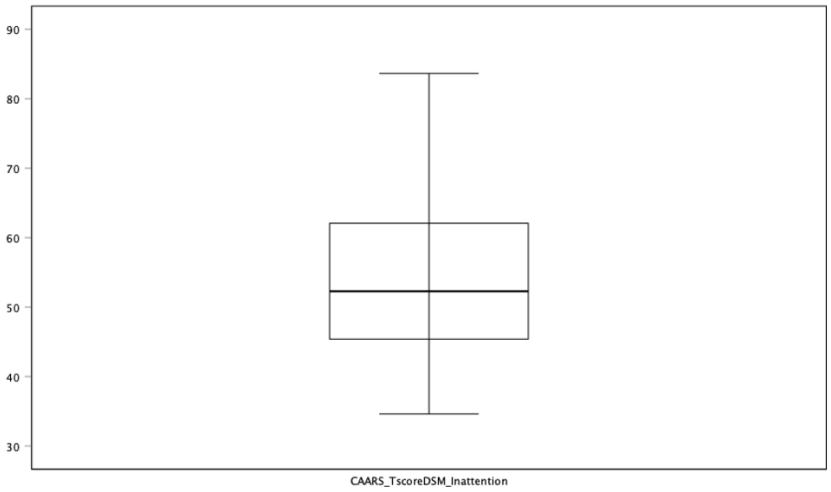

Figure 2.1 A Boxplot of the CAARS Inattention data.

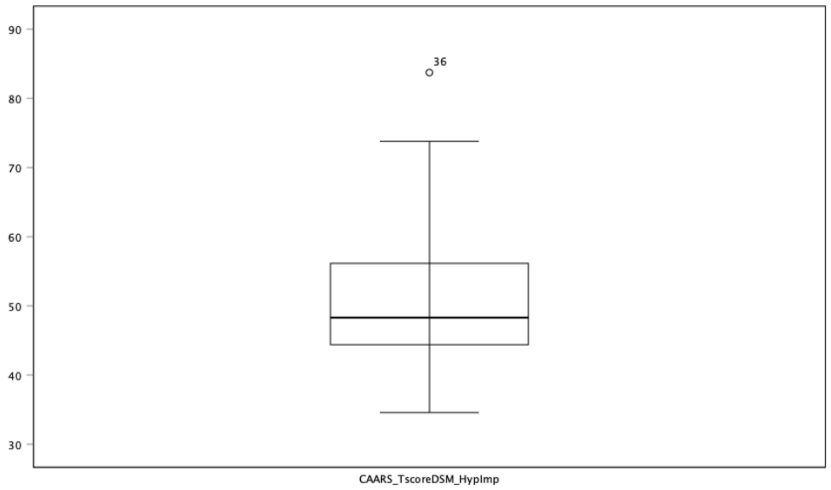

Figure 2.2 A Boxplot of the CAARS HypImp data.

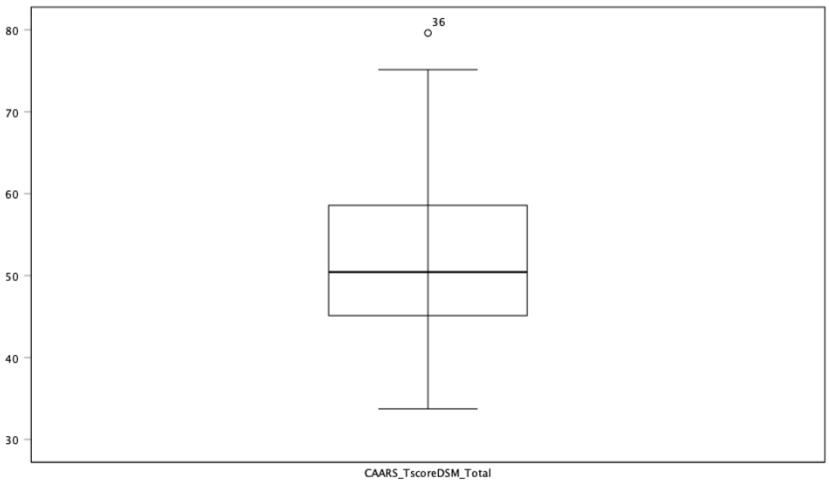

Figure 2.3 A Boxplot of the CAARS Total data.

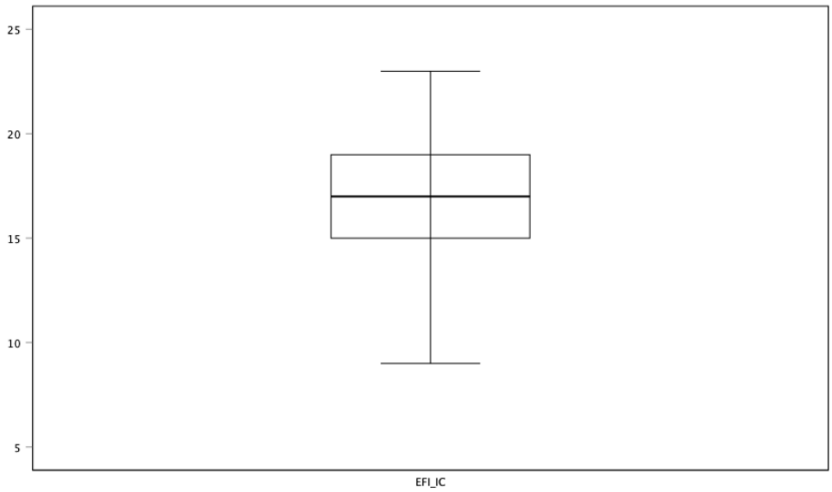

Figure 2.4 A Boxplot of the EFI Impulse Control data.

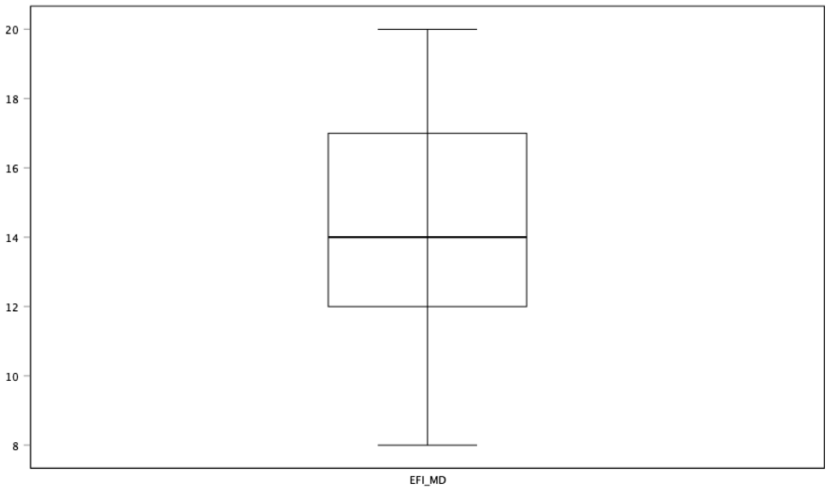

Figure 2.5 A Boxplot of the EFI Motivational Drive data.

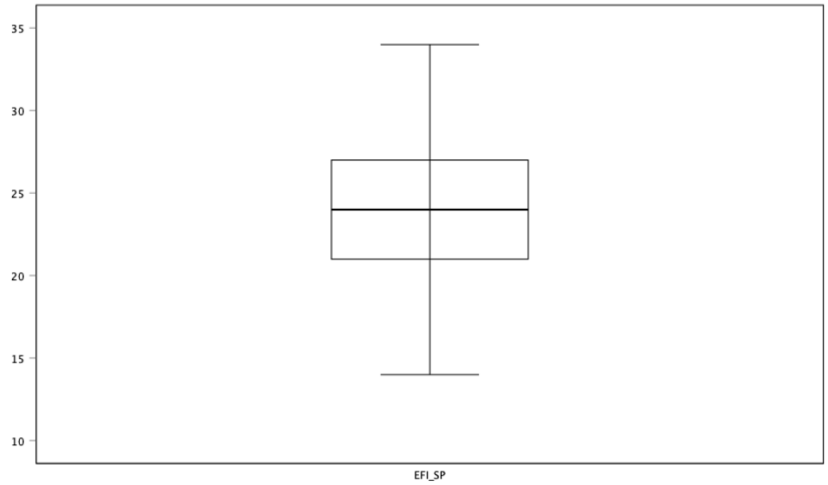

Figure 2.6 A Boxplot of the EFI Strategic Planning data.

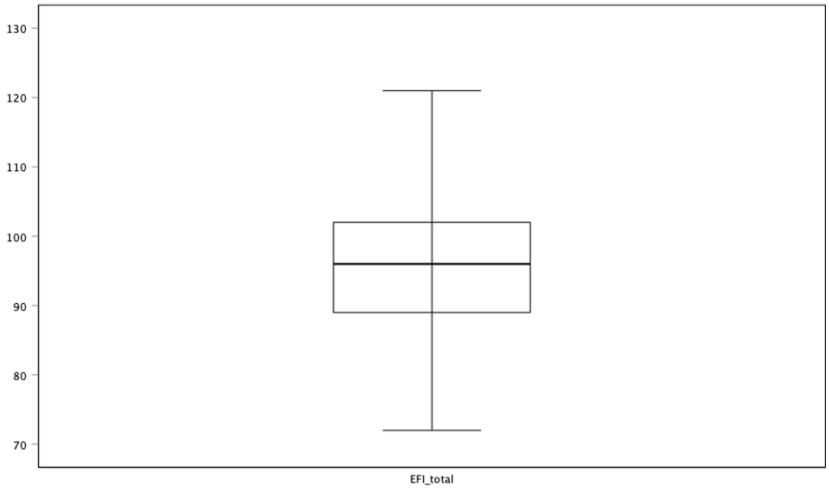

Figure 2.7 A Boxplot of the EFI Total data.

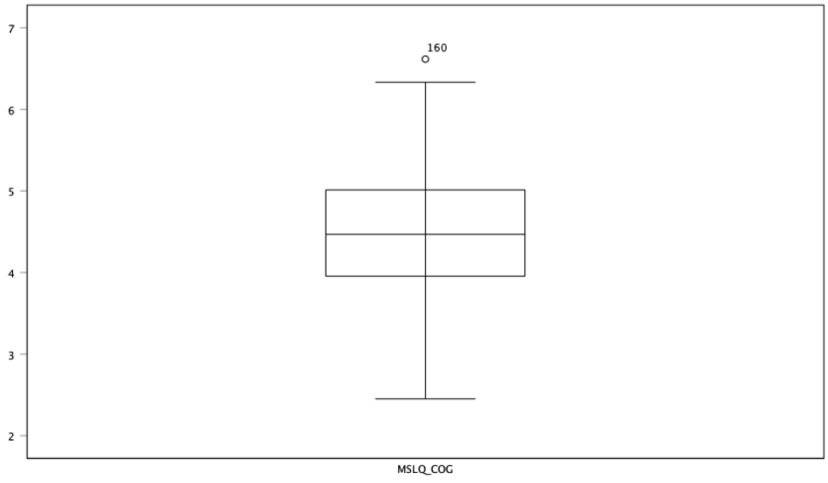

Figure 2.8 A Boxplot of the MSLQ Cognitive data.

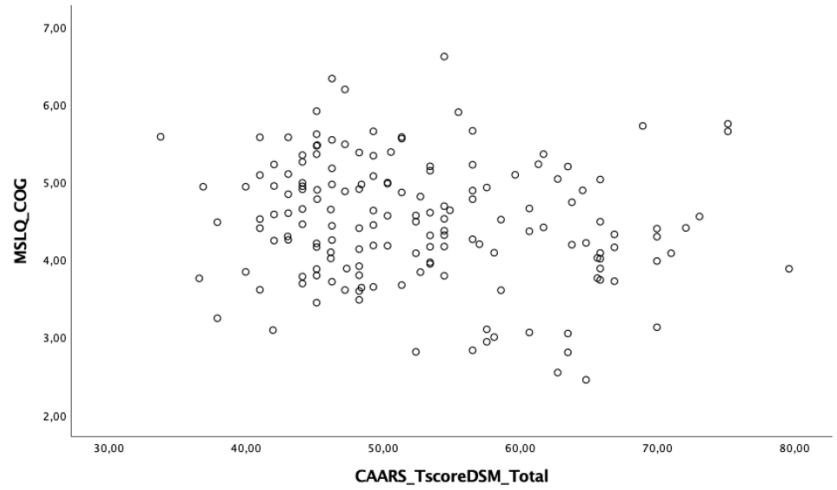

Figure 3.1 Scatterplot MSLQ Cognitive and CAARS Total

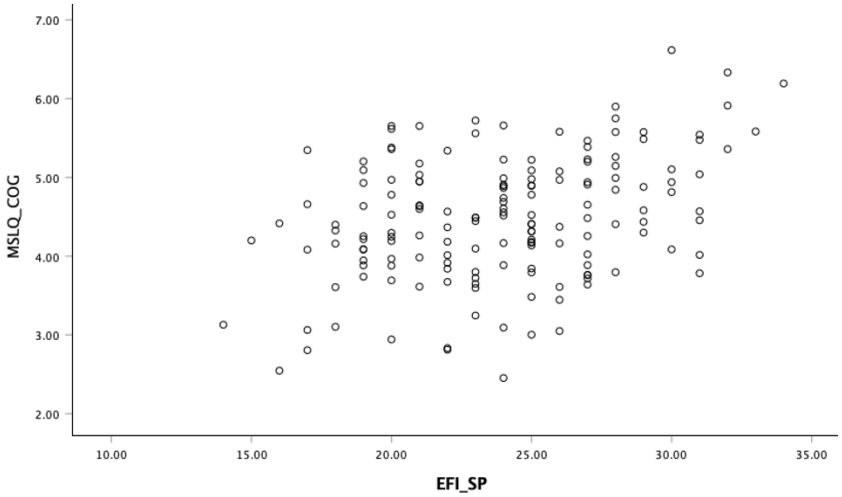

Figure 3.2 Scatterplot MSLQ Cognitive and EFI SP

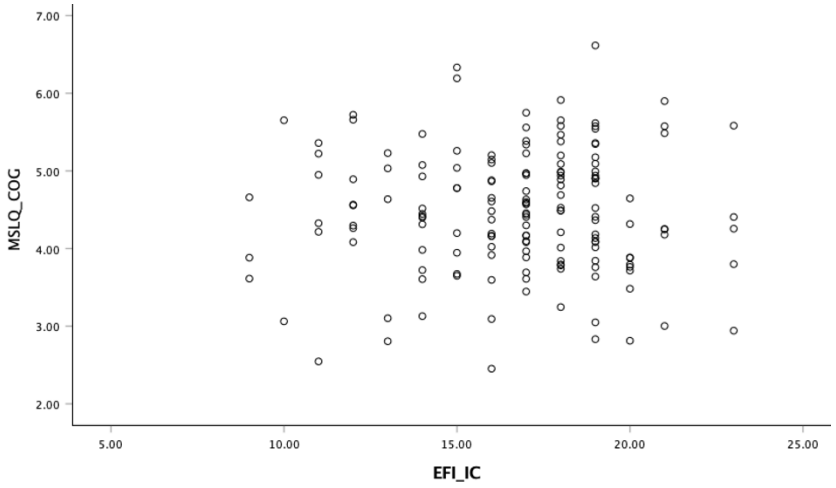

Figure 3.3 Scatterplot MSLQ Cognitive and EFI IC

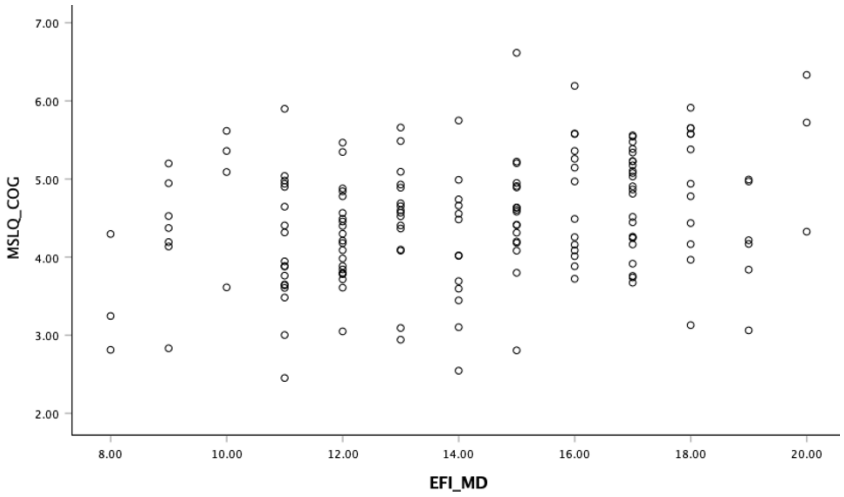

Figure 3.4 Scatterplot MSLQ Cognitive and EFI MD

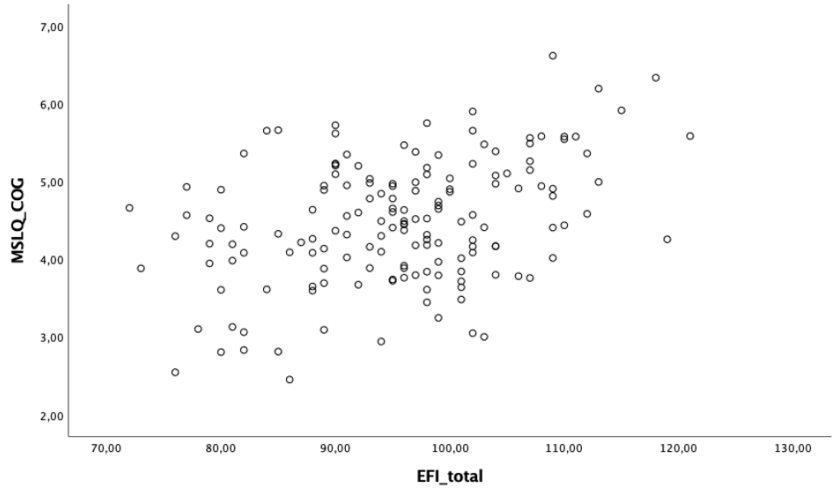

Figure 3.5 Scatterplot MSLQ Cognitive and EFI Total

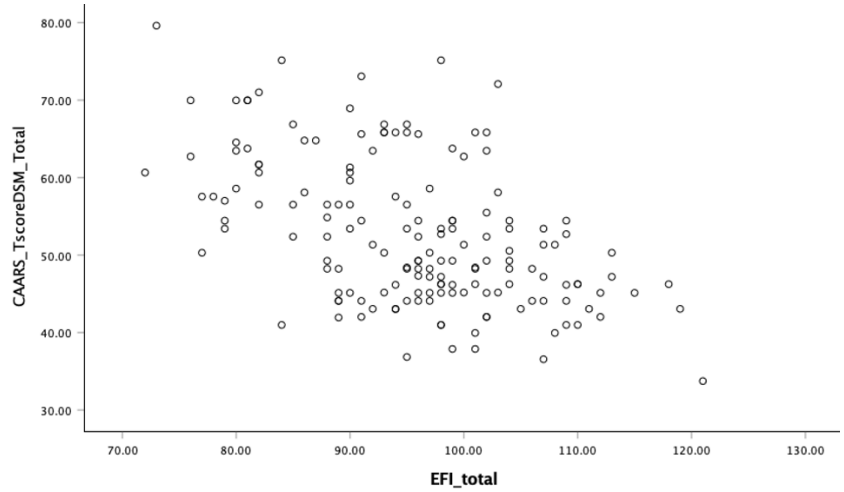

Figure 3.6 Scatterplot CAARS Total and EFI Total

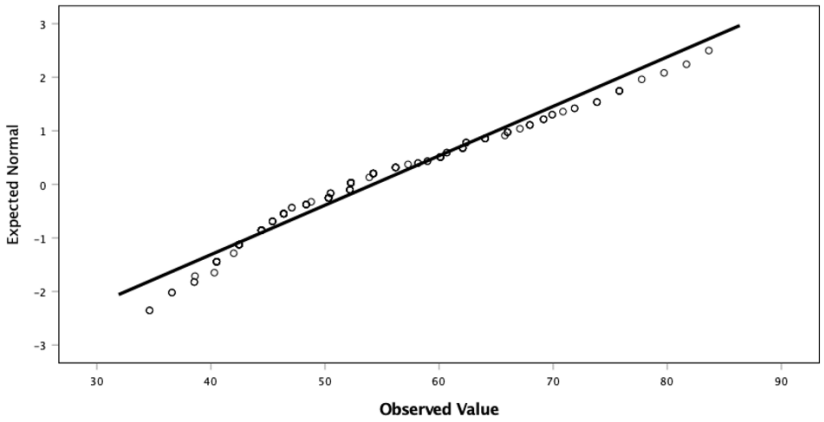

Figure 4.1 Normal Q-Q Plot of CAARS Inattention

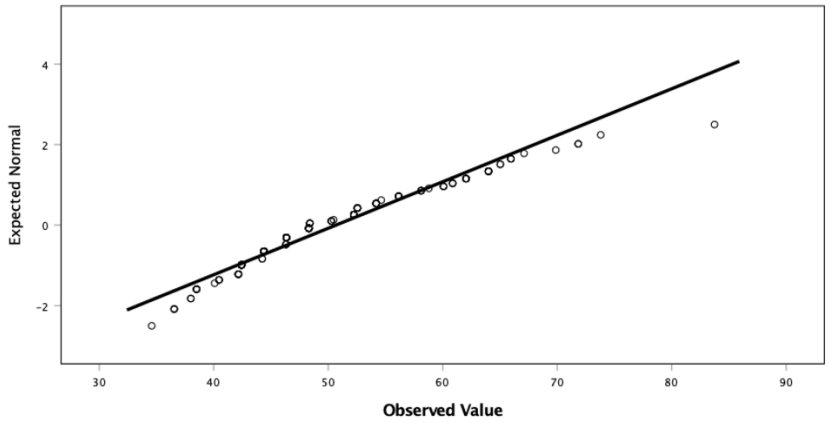

Figure 4.2 Normal Q-Q Plot of CAARS Hyperactivity/Impulsivity

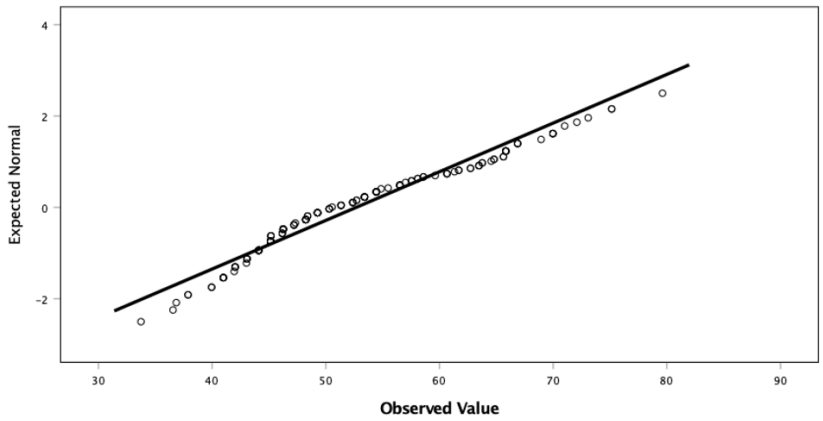

Figure 4.3 Normal Q-Q Plot of CAARS Total

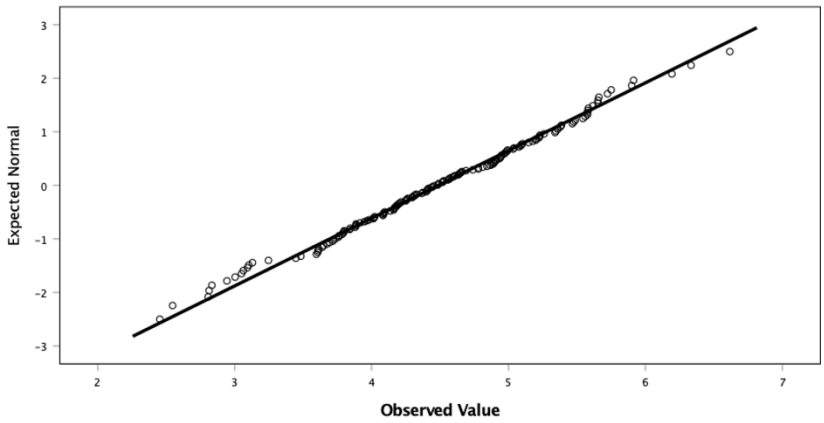

Figure 4.4 Normal Q-Q Plot of MSLQ Cognitive

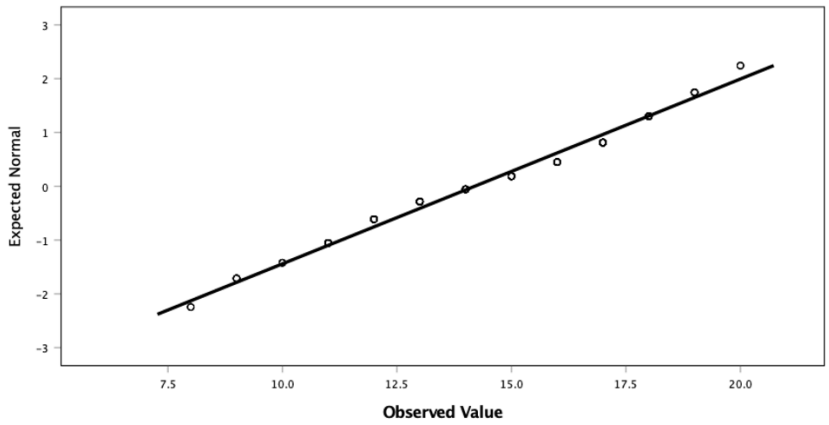

Figure 4.5 Normal Q-Q plot of EFI MD

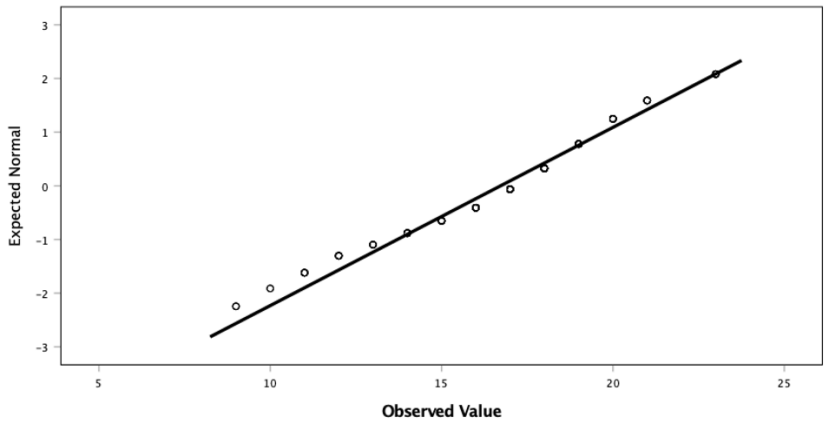

Figure 4.6 Normal Q-Q plot of EFI IC

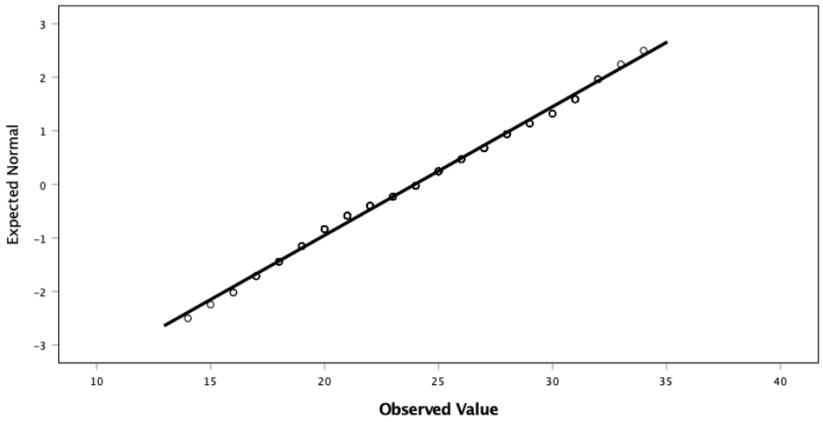

Figure 4.7 Normal Q-Q plot of EFI SP

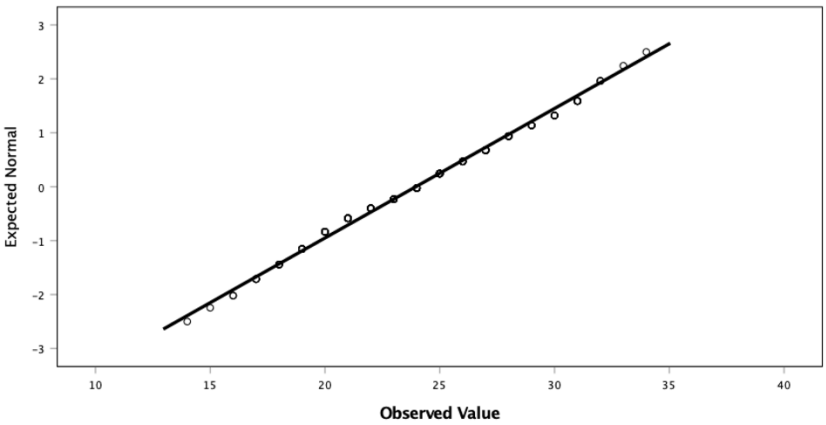

Figure 4.8 Normal Q-Q plot of EFI Total

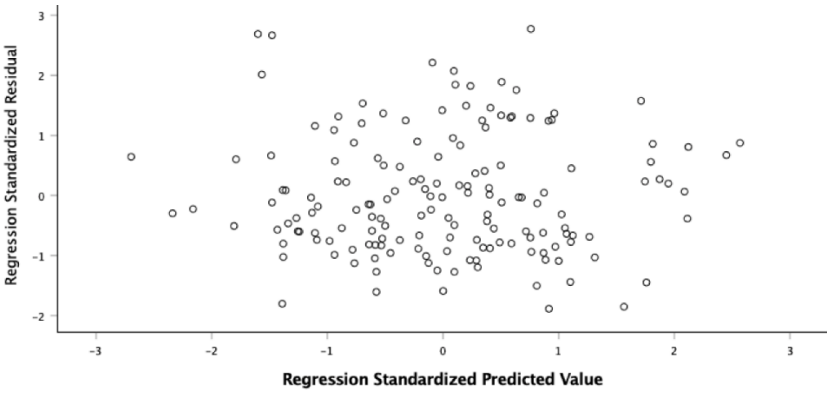

Figure 5.1 Scatterplot of Residuals CAARS Total and MSLQ Cognitive

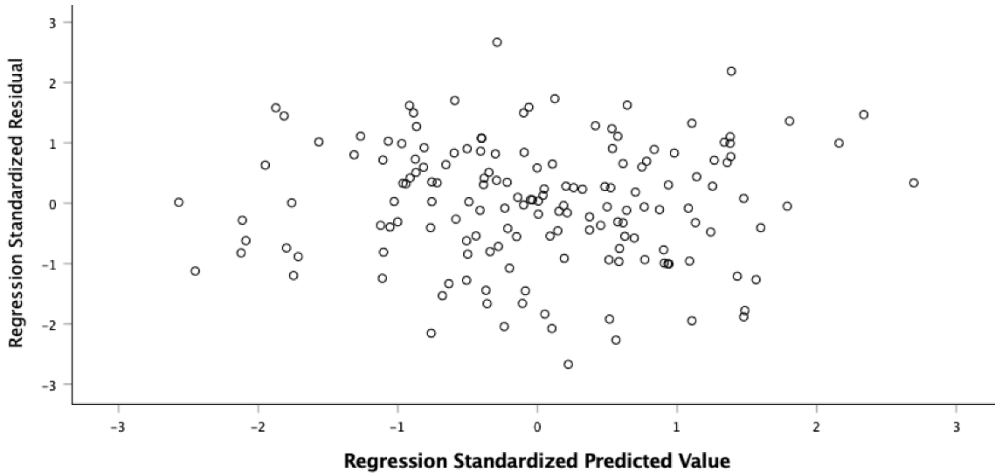

Figure 5.2 Scatterplot of Residuals EFI Total and MSLQ Cognitive

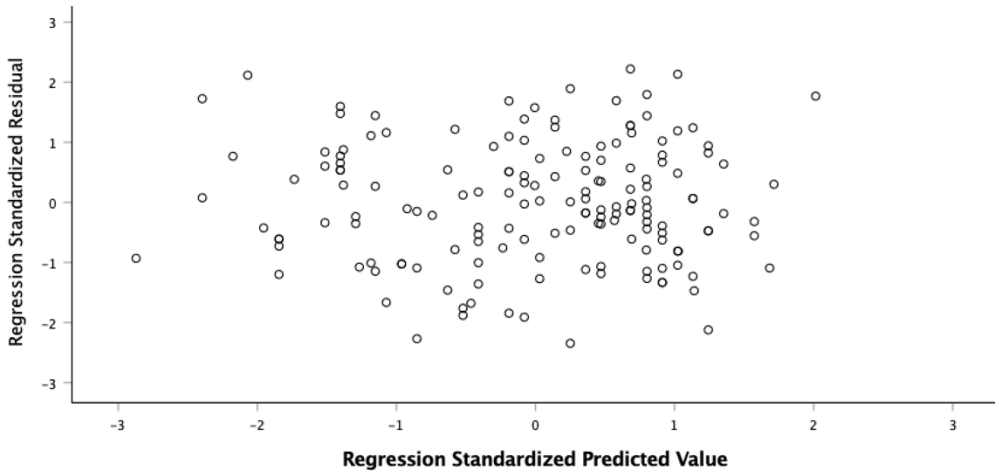

Figure 5.3 Scatterplot of Residuals CAARS Total and EFI Total

Appendix C

Table 2

Correlation Matrix. This table presents the correlations of the ADHD subgroups, Executive Functioning subgroups and the Cognitive SRL strategies

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. CAARS Inattention	1									
2. CAARS HypImp	.60**	1								
3. CAARS Total	.91**	.86**	1							
4. EFI ORG	-.62**	-.41**	-.59**	1						
5. EFI SP	-.41**	-.28**	-.39**	.30**	1					
6. EFI IC	-.34**	-.47**	-.44**	.32**	.36**	1				
7. EFI EM	-.05	-.06	-.07	-.05	.30**	.21**	1			
8. EFI MD	-.10	.21**	.03	.05	.03	-.18*	.25**	1		
9. EFI Total	-.54**	-.36**	-.51**	.56**	.75**	.59**	.59**	.35**	1	
10 MSLQ_COG	-.18*	-.09	-.16*	.07	.36**	.00	.34**	.28**	.38**	1

Note: CAARS: Connors' Adult ADHD Rating Scales; ORG: organization; SP: strategic planning; IC: impulse control; EM: empathy; MD: motivational drive; MSLQ: Motivated Strategies for Learning Questionnaire; COG: cognitive; HypImp: subgroup hyperactive/impulsive from ADHD. **p < .01 level, *p: <.05.

Table 7

Coëfficiënts

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	31.873	8.312		3.835	<.001		
	EFI ORG	-.048	.194	-.019	-.248	.804	.572	1.748
	EFI SP	.168	.149	.081	1.132	.259	.644	1.553
	EFI IC	-.742	.197	-.258	-3.762	<.001	.699	1.431
	EFI EM	-.103	.170	-.040	-.605	.546	.733	1.364
	EFI MD	.750	.190	.252	3.941	<.001	.804	1.243
	CAARS Inattention.	.437	.063	.547	6.959	<.001	.533	1.877
	MSLQ COG	-.843	.730	-.077	-1.155	.250	.739	1.352

a. Dependent Variable: CAARS HypImp

Note: This table presents the coefficients of the Executive Functioning subgroups and the Cognitive SRL strategies subgroup with or the ADHD Inattention subgroup or the ADHD-Hyperactive/Impulsive. CAARS: Connors' Adult ADHD Rating Scales; ORG: organization; SP: strategic planning; IC: impulse control; EM: empathy; MD: motivational drive; MSLQ: Motivated Strategies for Learning Questionnaire; COG: cognitive; HypImp: subgroup hyperactive/impulsive from ADHD; B: unstandardized coefficient; Std. Error: standard error; Beta: the "unit-free" measure of effect size; t: t-test; Sig: significance; VIF: variance inflation factor.