The Relationship Between ADHD and Self-Regulated Learning in University Students: Exploring the Role of Self-Compassion

Madlen Härtel

S3983560

Department of Psychology, University of Groningen

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Supervisor: Dr. Yvonne Groen

Second evaluator: Prof. Dr. H.A.L Kiers

In collaboration with: Ajani Yokeeswaran, Ivan Pickman, R.A. Jamin and Sophie Plaiser

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Abstract

Objective: The present study investigates the relationship between ADHD and self-regulated learning (SRL) among university students, with an exploratory focus on self-compassion (SC) as a potential mediator or moderator in the relationship. **Method:** Participants were 168 psychology students from a university in the Netherlands, aged 16 to 29 (M=19.68, SD=1.96). ADHD was assessed using the Connor's Adult ADHD Rating Scale (CAARS), SRL was measured through the Motivated Strategies for Learning Questionnaire (MSLQ) and the Self-Compassion Scale (SCS) was used to assess SC. **Results:** We found a negative association between ADHD and both SRL and SC. However, SC was not significantly associated with SRL and the results do not indicate a mediating or moderating effect of SC. **Conclusion:** This study is the first to investigate ADHD in relation to self-regulated learning as well as self-compassion in university students. The findings suggest that university students with higher levels of ADHD symptoms use fewer self-regulated learning strategies and are less compassionate with themselves compared to university students without ADHD. Interventions focusing on these relationships might improve academic performance in university students with ADHD.

Introduction

Core symptoms of attention-deficit hyperactivity disorder (ADHD), namely inattention, hyperactivity and impulsivity, often persist into adulthood and contribute to difficulties in various life domains, including academia (Sedgwick-Müller et al., 2022) Henning et al., 2022). Although there is a gradual increase of research on ADHD in adults, its exploration within the academic domain is lacking. This is especially problematic as literature indicates the importance of differentiating between the subgroup of college students and the overarching adult population (Lefler et al., (2021). Research shows that college students with ADHD display lower college grade point averages (GPA) and lower American College Test (ACT) scores when compared to student populations without ADHD (Advokat et al., 2011; DuPaul et al., 2009; Heiligenstein et al., 1999; Weyandt & DuPaul, 2006). Other impairments, prevalent in college students with ADHD, are occurrences of failing grades and grade retention, requirement for academic support (Wolf, 2001) and incidences of being placed on academic probation (Heiligenstein et al., 1999; Weyandt & DuPaul, 2006).

According to Lefler et al., (2021) the unique obstacles that college students with ADHD are confronted with suggest that assessment and diagnostic procedures should be handled in a specialised way as well. Lefler et al., (2021) discusses the validity of DSM-5 criteria of ADHD, as these might not be diagnostically sensitive enough for the unique presentation of ADHD symptomatic in college students. For instance, rather than dividing ADHD symptoms into clusters (inattention, hyperactivity, impulsivity), it may be more beneficial to assess all symptoms together in college students. Furthermore, Lefler et al., (2021) argues that the distinction between late-onset and late-identified ADHD is relevant. That is, late identification of ADHD is prevalent among college students, yet this does not imply the absence of symptoms during childhood. Instead, symptoms might have been overlooked in the past due to compensatory strategies, more external structure or other ways of manifesting themselves (e.g., anxiety, depression, substance abuse). These considerations,

among others, emphasise the necessity for research to specifically look into ADHD in higher education. Consequently, the present study aims to address this research gap by investigating the presentation of ADHD in the population of university students.

In the attempt to identify predictive factors for academic disabilities evident in college students with ADHD, studies found that self-regulated learning (SRL) is linked to academic success. Specifically, SRL refers to the extent to which students engage in the management of resources (e.g., professional exchange with peers or faculty members), the regulation of motivation, including goal orientation (e.g. mastery of material) and affect (e.g. anxiety), and lastly, (meta-) cognitive strategies targeted on the improvement of learning such as deep-processing based strategies (Pintrich et al., 1993).

Shelton et al. (2019) were the first to discover a negative relation between ADHD and SRL, investigating the effect of inattention- and hyperactivity symptoms on SRL-strategies in college students. It was found that inattention symptoms significantly predict deficits in use of SRL strategies. Relevantly, research shows us that inattentiveness often persists into adulthood, while hyperactivity tends to diminish with increasing age (DuPaul et al., 2009; Weyandt & Dupaul, 2008). Thus, due to the proportionally high expression of inattentiveness, the transformation from lower education to the academic environment can be especially challenging. Inattention symptoms collide with higher demands for self-regulated learning due to loss of external structure in college (Wolf, 2001; Wolf et al., 2009). This might be another reason why many students get diagnosed with ADHD when entering college.

In addition to ADHD and SRL, another factor that could impact academic achievement is self-compassion (SC). Previous findings reveal that self-compassionate attitudes are linked to academically desirable behaviour, such as reduced procrastination and mastery goal orientation (Akin, 2008; Neff et al., 2005; Sirois, 2014). This might be because students who are kinder towards themselves tend to experience less fear of failure and higher perceptions of self-competence (Neff et al., 2005). Notably, individuals with ADHD show

lower levels of SC (Willoughby and Evans, 2019; Beaton et al., 2020). An explanation for this could be the tendency of individuals with ADHD to be more self-critical due to the disabilities they face throughout their lives (Canu et al., 2008; Hoza, 2007; Psychogiou et al., 2007). Considering the documentation of a negative relation between SC and ADHD, along with the positive relation between SC and SRL, we assume that SC might play a relevant role in the relation between ADHD and less use of SRL strategies.

The present study aims to partially replicate the findings of Shelton et al. (2019) by investigating the use of SRL strategies in university students with self-reported levels of ADHD symptoms. Furthermore, the potentially mediating or moderating effect of self-compassion in the association between ADHD and SRL use will be examined. Gaining a better understanding of SRL strategies in student populations with ADHD and of the role of self-compassion in academia is crucial for designing effective interventions adjusted to the academic needs of students with ADHD.

In the following, all relevant constructs and their individual relations to ADHD will be discussed. These relations build the theoretical fundament for our hypotheses, following afterwards.

Self-Regulated Learning and ADHD

Self-regulated learning strategies are less prevalent in college students with ADHD compared to students without ADHD (Shelton et al., 2019). Three components of SRL are assumed to play a role in this relationship. The first component refers to an individual's internal expectancies, reflecting the extent to which one believes in their ability to control their academic outcomes through their own actions and strategies. This involves the perception of self-competence and self-efficacy. Secondly, internal values such as motivation and interest in the material are seen as important, shaping one's sense of relevance and usefulness of academic task completion. Notably, being intrinsically motivated to develop competence in the subject matter (mastery goal orientation) has been significantly linked to academic success (Dweck, 1999; Wolters et al., 1996). The final component is self-

regulation, related to mechanisms such as planning, monitoring and regulating one's own learning. Academic self-regulation involves the maintenance of effort when studying, regardless of external distractions or personal interest in the material.

College students with ADHD often find it challenging to use SRL strategies effectively, as evidenced by Shelton et al., (2019). Deficiencies across all three SRL components are found in college students with ADHD. For instance, college students with ADHD tend to have poorer organisational skills (Turnock et al., 1998), lower abilities of self-testing, information processing and prioritising ideas (Reaser et al., 2007). These deficits reflect shortcoming on the dimension of internal expectancies. Furthermore, evidence reveals that ADHD correlates with lower levels of motivation, self-control and self-discipline in college students (Turnock et al., 1998), showing deficits in the category of internal values. Interestingly, Wallace et al. (1999) found that the perception of self-competence is highly predictive for academic achievement, particularly in individuals with ADHD. Finally, difficulties with academic self-regulation are shown in findings suggesting that students with ADHD have more difficulties with time management (Reaser et al., 2007) and timed tests (Lewandowski et al., 2009), as well as a tendency to procrastinate and to not make use of resources such as note taking (Advokat et al., 2011).

Taken together, Students with ADHD may face a disadvantage in utilising necessary skills for self-regulated learning and academic performance. The present study aims to replicate the findings of a negative relationship between ADHD and SRL.

Self-Compassion and Self-Regulated Learning

Exploring the relationship between SC and SRL, SC was found to be of help in the academic domain in numerous ways, buffering against passivity, promoting motivation for growth and leading to a more realistic self-view (Neff et al., 2005). According to the definition of Neff (2003), SC can be classified into three components: self-kindness, common humanity and mindfulness. Self-kindness involves being kind towards oneself in painful situations or instances of failure, as opposed to being overly self-critical. Common humanity

means perceiving one's experiences as integrated in the overall human condition, rather than as isolating and separating. The component of mindfulness refers to the maintenance of a balanced awareness of emotional pain. This includes the full awareness and experience of pain without getting carried away in over-identification. Neff (2005) argues that especially the component of self-kindness might result in a greater perception of self-competence. Thus, as the sense of self-competence was found to be highly predictive for academic success in students with ADHD (Wallace et al., 1999), self-kindness might be of special relevance for college students with ADHD. While research did not find a direct link between SC and SRL yet, a large body of evidence suggests that self-compassion is closely related to academic achievement. For instance, learning behaviours observed in high-achieving students (Dweck, 1999; Wolters et al., 1996), such as intrinsic motivation and mastery goal orientation, were found to be positively associated with SC (Akin, 2008; Neff et al., 2005). Longitudinal research found that SC serves as a protector against negative emotions in stressful situations (Hope et al., 2014), which might indirectly affect academic self-regulation. Moreover, an experimental study investigated how university students responded to regular SC-training compared to regular self-esteem-training and control conditions. Here it was found that after undergoing training in SC, students displayed more proactive behaviour and motivation for learning from their academic mistakes, as well as more time investment in studying for an experimental task (Smeets et al., 2014; Breines and Chen, 2012). In line with this, other experiments revealed that training in SC has shown positive side effects in other academic self-orientations, including self-efficacy. Self-efficacy is closely linked to the SRL-component of internal expectancies (Shelton et al., 2019). Moreover, Willoughby et al., (2019) found that a different form of positive self-perception, namely self-acceptance, is directly associated with SRL.

Overall, there is a substantial body of evidence supporting the positive association between SC and the use of SRL strategies in the general student population. The present study aims to investigate whether this extends to students with ADHD symptoms.

ADHD and Self-Compassion

New insights on the link between ADHD and SC show that SC is lower in individuals with ADHD (Willoughby & Evans, 2019; Beaton et al., 2020). This might be associated with impairments in executive functioning such as less impulse control and motivation, leading to emotional dysregulation. This is important as emotion regulation skills appear to be closely related to various internal processes that are relevant for self-compassion (Paucsik et al., 2022). Furthermore, ADHD might elicit a more negative environment with a higher risk for stress, rejection and failure (Canu et al., 2008; Hoza, 2007; Psychogiou et al., 2007), which is likely to negatively impact mental health (Simmons & Antshel, 2020) and subsequently impairs the development of healthy self-attitudes such as SC. Neff (2003) argues that SC might be learned through experienced compassion in social interactions with others, such as caregivers. Research on early life experiences of individuals with ADHD show that there is evidence for an elevated risk of childhood maltreatment (He & Li, 2022; Ratanatharathorn et al., 2021; Briscoe-Smith & Hinshaw, 2006; Capusan et al., 2016; Sanderud et al., 2016; Wang et al., 2020). Thus, childhood maltreatment might be related to low experienced compassion of caregivers and reduce the potential of individuals to develop SC later in life. This is in line with findings from a systematic review and meta-analysis, indicating that overall and subforms of childhood maltreatment are correlated with decreased self-compassion (Zhang et al., 2023).

Altogether, these findings and their theoretical background indicate a negative association between ADHD and SC. Theory suggests that symptoms of ADHD predict low levels of self-compassion later in life.

Research Question and Hypotheses

In summary, links between all variables of interest are established. Firstly, there appears to be a negative association between ADHD and the use of SRL as college students with ADHD show deficiencies across all three SRL components: internal expectancies, internal values, and self-regulation. Secondly, research indicates that individuals with ADHD

exhibit lower SC, potentially influenced by impaired executive functioning and adverse environmental factors. Lastly, longitudinal and experimental research (Neff et al., 2005; Neff et al., 2017) support the predictive effect of SC on academic achievement. Research shows that self-compassionate college students tend to approach challenges with more resilience and self-kindness, promoting the implementation of SRL techniques.

The fact that SC seems to be related to both the hypothesised predictor and the hypothesised dependent variable raises the question whether self-compassion might affect the relationship between ADHD and SRL as a moderator or mediator. It is important to note that a recent study, investigating self-compassion in 232 university students with ADHD, found that uncompassionate self-responding (USR) fully mediated the relationship between ADHD and well-being, and partially mediated the relationship between ADHD and distress (Farmer et al., 2022). In a series of mediation analysis Farmer et al., (2022) identified processes of emotion regulation as a key-aspect in the mediation effect of USR (this holds special relevance for individuals with ADHD, as they are known to have difficulties with emotion regulation). Another study based on a sample of 3,112 university students found a mediating effect of SC on the relationships between academic distress and different forms of perfectionism, including adaptive and maladaptive perfectionism (Kawamoto et al., 2022).

Not only do these findings indicate that the degree of USR is crucial for (academic) well-being in individuals with ADHD symptoms, but the findings from (Farmer et al., 2022) also generalise to our target population of university students. These findings further build on our theoretical foundation for investigating SC in the context of ADHD in university students and self-regulated learning.

The present study primarily investigates the relationship between ADHD and self-regulated learning. In addition to this, we will analyse the potential role of self-compassion in this relationship. Our hypotheses include: 1) a negative association between ADHD symptoms and the use of SRL strategies, 2) a negative association between ADHD symptoms and self-compassion, and 3) a positive association between self-compassion and the use of

SRL strategies. We take an exploratory approach to look into the potentially mediating or moderating effect of self-compassion in the association between ADHD and self-regulated learning.

By investigating these dynamics, we hope to contribute to a more comprehensive understanding of the mechanisms underlying academic difficulties in individuals with ADHD symptoms.

Methods

Participants

The sample of our study consisted of first-year students from the Dutch and International track of the Psychology BSc. program of the University of Groningen (UG). The participant recruitment was facilitated through the Experiment Management System (SONA), serving as an integral component of the students' coursework. Participation was entirely voluntary and as a compensation for the involvement in the study all participants received a small amount of course credits (SONA credits) needed for the completion of their class.

Prior to the involvement in the present study participants underwent a self-report assessment on ADHD symptomatology (see materials section). Inclusion criteria for this study included language proficiency in English and presence of the self-report assessment on ADHD symptoms. The sample consisted of N = 237 participants, but 68 were excluded from the analysis for reasons such as incomplete data or failure to correctly answer the honesty/attention question and the inconsistency/infrequency index (see materials section). This resulted in a final sample of N = 169, of which 22.5% were male (n=38), 75.7% female (n=128), and 1.8% other (n=3). The mean age was 19.7.

Materials

Motivated Strategies for Learning Questionnaire

The Motivated Strategies for Learning Questionnaire (MSLQ) investigates both motivational and cognitive components of academic learning strategies (Pintrich, 1995). The

sum of this self-reported instrument includes 85 items, which were designed to measure the attitudes and learning strategies (Wang et al., 2022). In our study, the questions were referred to the course Introduction to Psychology (English track) or Overzicht in de psychologie (Dutch track). Items are scored through a 7-point Likert-type scale ranging from 1 (not at all true of me) to 7 (very true of me). The MSLQ is divided into 15 different subscales. The questionnaire contains a motivation section that measures the goals of value beliefs for a course, their perceptions of their capacity to succeed in a course and their anxiety around course exams. The motivation section is measured within six different sub-scales. From the motivations scale we use the subscales Value and Expectancy. The MSLQ also contains a learning strategies section. This part includes the items regarding students' use of different cognitive and metacognitive strategies and items concerning student management of different resources. From this section we only use the subscale Cognitive and Metacognitive Strategies (Duncan & McKeachie, 2005) (Hilpert et al., 2013).

According to Hilpert at al. (2013) the MSLQ proves to have an internal consistency rating ranging from .83 to .92. Furthermore, the MSLQ shows predictive validity when compared to the questionnaire outcome with the final attainable grade. However, the correlation has a modest value (Shelton et al., 2019).

Connor's Adult ADHD Rating Scale and Infrequency Index

Connor's Adult ADHD Rating Scale (CAARS) is a questionnaire used to measure a cross-section of symptoms and behaviours that are related to ADHD in adults (Erhardt & Sparrow, 1999). Different versions of the CAARS exist. There are short or long versions, and self-report or observer ratings. In the current study the CAARS-S:L was assessed, which is the self-report long form.

The CAARS-S:L consists of 66 items with nine subscales of four factor-derived subscales, three symptom measures according to the DSM-IV (APA, 1994), an ADHD Index and an Inconsistency Index subscale. To measure ADHD symptoms, the subscale *CAARS DSM Total* (based on the DSM-IV) is used. This measures the total amount of ADHD

symptoms without differentiation between the inattentive or hyperactive-impulsive symptoms (APA, 1994).

The Inconsistency Index is constructed to evaluate inconsistency in responding to items that measure related content (e.g., 'I'm disorganized' and 'I'm absent-minded in daily activities'). The items are measured on a 4-point Likert-scale from (0 = Not at all, never; 1 = Just a little, once in a while; 2 = Pretty much, often, 3 = Very much, very frequently). The self-report forms were normed on a large sample of nonclinical adults (N=1.026) ranging from 18 to 72 years old.

The CAARS-S:L has shown to be a valid measure of ADHD symptoms. According to Erhardt & Sparrow (1999) the test met the criteria for good fit, and the intercorrelations of the subscales provided support for the multidimensionality of the CAARS. Both indicate factorial validity. The four factor-derived subscales and the ADHD Index were assessed for discriminant validity with both showing good results (the former 85% overall correct classification and the latter 73% overall correct classification) (Erhardt & Sparrow, 1999). Lastly the construct validity was evaluated by looking at the relationship between; childhood and current symptoms; and self-report and observer ratings. Both cases support the argument that the CAARS has a good construct validity (Erhardt & Sparrow, 1999). For the target population, the DSM-IV Total scale serves as an appropriate measure. Lefler et al. (2021) discovered that a unidimensional model (as opposed to a two or three-factor model that differentiates between hyperactivity, impulsivity, and attention) is most suitable for analysing the population of college students.

The CAARS-S:L does not include a measure to assess noncredible self-report. The included Inconstancy Index only measures inconsistency in responding to items that measure the same content. An Infrequency Index for CAARS (CII) was therefore designed by Suhr et al. (2010). According to their research it is not difficult for a motivated participant to identify ADHD symptoms and to simulate having these, which makes it necessary for an additional instrument that measures this potential overreporting (Suhr et al., 2010). The constructed CII

was found to have a good internal consistency with a Cronbach's Alpha of .86. Using a cutoff score of 20 was found to give the best results, being specific and relatively sensitive to an external criterion of validity, noncredible cognitive performance. The use of the CII adds 15 items to the CAARS-S:L making it a questionnaire with a total of 81 items.

The reliability of the CAARS-S:L has proven to be good. The internal consistency of the subscales found in the original study by Erhardt & Sparrow (1999) gives support for this claim, ranging from .64 to .91. The mean inter-item correlations also provide support for the reliability ranging from .14 to .64 in the original study (Ehardt & Sparrow, 1999). Finally, the test-retest reliability for the CAARS-S:L was originally evaluated with 61 individuals, with an interval of one month. The results showed only significant correlations ranging from .80 to .91. Because the present study only assessed the questionnaire once, no test-retest reliability could be measured. The mean inter-item correlations, ranging from .14 to .64 in the original study by Ehardt & Sparrow (1999) support the reliability of the measure. Additionally, the test-retest reliability of the CAARS-S:L was initially assessed with a sample of 61 individuals over a one-month interval, revealing consistently significant correlations between .80 and .91. Test-retest reliability could not be evaluated since it is a cross-sectional study.

Self-Compassion Scale

Self-compassion was measured by the long version of the Self-Compassion-Scale (SCS) invented by Neff (2003), which was developed by using an undergraduate sample with the average age of 21,3 years (N=71). The SCS is a self-report scale and consists of 26 items using a 5-point Likert-scale from 1 (Almost never) to 5 (Almost always). These 26-items are compartmentalized in six factors that measure self-kindness, self-judgement, common humanity, isolation, mindfulness, and over-identification. A confirmatory factor analysis (CFA) found an adequate fit to a six-factor inter-correlated. Additionally, a CFA found a marginal fit to a single higher order factor that could explain the inter correlations between subscales (Neff, 2003).

Further, the internal consistency for the 26-Items in the original study was found to be .92 (Neff, 2003). In addition, test-retest reliability of the SCS showed solely significant correlations ranging from .80 to .93 (Neff, 2003). Besides that, SCS could demonstrate internal reliability across different studies (e.g., Allen et al. 2012; Neff and Pommier 2013; Werner et al. 2012, as cited in Neff, 2016).

Moreover, the predictive validity could be demonstrated by investigating self-compassion as an independent variable on wellbeing (Neff, 2003). Furthermore, the SCS encompasses a high group validity, as tested by comparing a sample of practicing Buddhists with a sample of undergraduate students. The group of Buddhists did score higher on self-compassion than the undergraduates (Neff, 2003). Additionally, the SCS shows a good discriminative validity to other self-attitude scales who tested for concepts of self-esteem and narcissism (Neff, 2003).

Procedure

The study was reviewed and approved by the Ethical Committee of Psychology at the University of Groningen (PSY-2021-S-0054), as a study conducted in the context of a Bachelor's Thesis project. Participants were recruited via the first-year practicum platform SONA, allowing participants to acquire course credits. Only those participants whose demographic information was collected, and whose ADHD symptoms were assessed with the CAARS-S:L (Erhardt, & Sparrow, 1999) in the previous studies "PSY-2122-S-0006 Parts 1 & 2" were eligible to participate in the current study. The participants signed the informed consent form, stating that they consent to participation in the current study, as well as connecting it to the previous studies they participated in. Administration of the study happened digitally, via Qualtrics (https://www.qualtrics.com), participants were briefed about the study, then signed informed consent forms, and subsequently were able to begin the questionnaire parts of the study. Firstly, they completed the MSLQ, then the SCS, and thirdly they optionally, after consent, provided their grade on the course Introduction to Psychology/Inleiding in de Psychologie (PSBE1-01/PSBA1-01, respectively).

Before ending the survey, participants were asked to confirm whether they had answered seriously and honestly and whether they would allow us to use their data in our research. The ending screen saw them being instructed to click the red arrow in order to receive their SONA credits.

Statistical analysis

For our statistical analysis we relied on several assumptions for linear and multiple regression (see appendix). The additional computational tool compatible with SPSS, PROCESS Macro, developed by Hayes (2013), was used to statistically analyse the relationships between our variables of interest, as shown in Figure 1.

Firstly, we investigated the hypothesised negative association between CAARS DSM Total and MSLQ by assessing the total effect. Subsequently, we examined the hypothesised negative relationship between CAARS DSM Total and SCS, followed by testing our third hypothesis of a positive association between SCS and MSLQ.

Finally, we explored the mediation and moderation models. The mediation effect was assessed by analysing both the total effect and the direct effect of CAARS DSM Total on MSLQ, using the PROCESS Macro (Hayes, 2013). The moderation effect was investigated by examining the interaction effect. For this analysis, SCS was reversed, in order to bring our independent variables on the same directional level.

Figure 1

Mediation

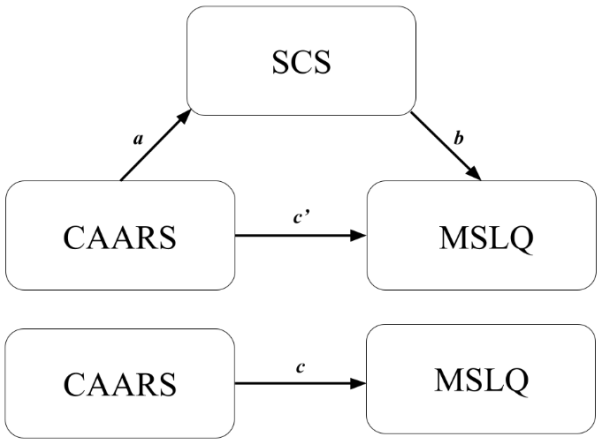
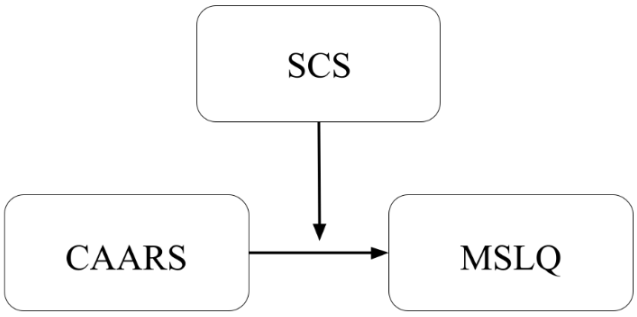


Figure 2

Moderation model



Results

Descriptives

Bivariate Correlations were computed. ADHD symptoms were negatively correlated with SRL (r=-.207, p < .01) and with SC (r=-.264, p > .01) and SC was positively correlated with SRL (r=.092, p = .118). Thus, the relationships between ADHD symptoms and SRL and between ADHD symptoms and SC were significant, while the relationship between SC and SRL was non-significant.

Descriptive analyses showed that scores on the CAARS DSM Total scale (M = 19.43, SD = 9.85) were consistent with previous data from the world health organization, investigating a sample of college students and revealing a prevalence of self-reported ADHD symptoms of about 15.9 percent (Mak et al., 2022). The mean score on SCS was equal to 2.75 with a standard deviation of 0.72, revealing moderate scores on SCS, and scores on MSLQ equaled a mean of 4.68 with a standard deviation of 0.57, reflecting moderate to high levels on this measure.

Main Analysis

The first hypothesis of a negative relationship between the CAARS DSM Total and MSLQ was tested by calculating the total effect (path c) (b=-0.136, se=0.005, R-

sq=0.044)This association was significant (t(168)=-2.7221, p<.01). Testing the second hypothesis involved assessing the hypothesised negative association between CAARS DSM Total and the SCS by calculating path a (b = -0.188, se = 0.005, R-sq = 0.07). Here we found a significant effect as well (t(168) = -3.522, p < .01). Finally, we examined the third hypothesis, which investigated whether the SCS was positively associated with MSLQ while controlling for CAARS DSM Total (path b). However, no significant association was observed (b = 0,037 se = 0.073, t(168) = 0,511, p = .6098).

To assess the significance of the mediation model, we analysed path c' (the direct effect). However, this association was found to be nonsignificant (b = -0.129, se = 0.005, t(168)=-2.485, p = .0139). In conclusion, the coefficient of the direct effect is not significantly closer to zero than the total effect, indicating no mediation effect of the SCS.

Lastly, we assessed the hypothesised moderation model and found it to be nonsignificant (R^2 = .007, F(3,168) = 1.263, p = .2628). The SCS, when reversed, also showed nonsignificance (b = 0.112, t(168) = 0.740, p = .4605). Additionally, the interaction between the independent variable CAARS DSM Total and the reversed SCS was not significant (b = -0.008, t(168) = -1.124, p = .2628). These results provide no evidence for a moderation effect of SCS in the relationship between CAARS DSM Total and MSLQ.

Discussion

We investigated the relationship between ADHD symptoms and the use of SRL strategies in university students. Moreover, we explored the potential mediating or moderating role of SC in this relationship. The analysis revealed evidence for hypothesis 1, that ADHD symptoms would be negatively associated with use of SRL strategies, as well as hypothesis 2, predicting that ADHD symptoms would be negatively associated with self-compassion. However, we did not find a significant relation between SC and SRL use. Exploring the role of SC further, our results indicate that SC does not mediate or moderate the relationship between ADHD and SRL use. Furthermore, the prevalence of ADHD symptoms in our sample falls within the average range observed among university students.

Specifically, recent data from an international survey on ADHD in college students suggests a prevalence of approximately 15.9% (Mak et al., 2022), aligning closely with the results obtained in our sample.

Strengths

There are several notable strengths in our study design. Importantly, it provides new insights to a combination of variables that has not been previously investigated, despite several indicators pointing in this direction. In addition to this, our findings are based on a substantial sample size, resulting in sufficient statistical power of our analyses. We also made use of validated questionnaires for the assessment and cleaned the data from unreliable responses, contributing to the methodological robustness as well as scientific validity and reliability of our study. A further strength is the dimensional approach we followed, which is found to be especially useful to disorders such as ADHD, due to its symptomatic nature, characterised by the high amount and intensity of certain experiences that are widely spreaded among neurotypicals as well (Coghill & Sonuga Barke, 2012).

Limitations and Future Directions

Some weaknesses need to be addressed as well. One limitation of the study is its cross-sectional design. Without temporal precedence, we cannot establish whether ADHD symptomatology plays a purely explanatory role in self-compassion and self-regulated learning or whether self-compassion and self-regulated learning affect ADHD symptomatology back. The same question of causality applies to the relationship between self-compassion and self-regulated learning. This limitation should be addressed by future research using longitudinal studies or experiments. Secondly, the sample of our study might not be generalizable to the general student population as it consists solely of psychology students in the first year of their studies. To improve the generalizability of these findings to the broader student population, future studies should aim to include a more diverse representation of university students, capturing the diversity of the overall student body.

However, it is important to note that despite the overrepresentation of certain subgroups (e.g., institution, study program, study year), our findings may apply to similar demographics, such as the subpopulation of first-year students in social and behavioural sciences at Dutch research universities.

Furthermore, we relied solely on self-report measures, increasing the risk for false positives and response bias such as social desirability. In our study, the latter could have been of relevance as the students reported academic competencies directly to their universities. These reports might be possibly influenced by a subconscious desire to maintain a positive impression. A way to counterbalance these threats to validity might be the implementation of more objective measures, such as clinical interviews. While these forms of assessments are prone to social desirability as well, the validity could be enhanced by the careful evaluation of a trained professional clinician.

A further limitation comes along with the dimensional approach we used. While the dimensional approach usually has strong predictive validity when applied to symptomatology that equals extreme deviation of normal variation in behaviour (Coghill & Sonuga Barke, 2012), it might be associated with the potential for overinterpretation and a loss of information (Tellings, 2020), raising the susceptibility for false positives. Without clear cut-off points, individuals showing mild symptoms are taken into account into the analyses of our study, although diagnostic criteria might evaluate such mild symptoms as normal variation or the symptoms might be the results of alternative disorders impairing executive functioning. A way to keep the strengths of the dimensional approach while counteracting its limitations might be to use a combination of the dimensional and categorical approach. This could involve combining self-report measures or interviews with close ones with medical records on diagnoses and treatment history. This approach might capture both the continuum of symptoms and the presence or absence of specific disorders. This would likely enhance the validity and reliability of future research investigating ADHD symptoms.

The homogeneity of our sample might explain the weak association between ADHD and self-regulated learning in our sample. One could assume that psychology students might share characteristics that buffer against the effect of ADHD on self-regulated learning to a certain degree. Examples for these characteristics might include higher education on mental health problems, a subsequently higher chance to seek psychological treatment or a higher use of coping strategies. Furthermore, it's important to consider bias related to self-selection. That is, due to their complex and cognitively demanding nature, psychology studies might require more self-study than other university programmes. Consequently, individuals with already well-established SRL skills might be more inclined to choose this program. This might have contributed to an overall reduction of the effect of ADHD symptoms on SRL use in our sample. Thus, there is the possibility of hidden variables that moderate or mediate the relationship between ADHD and self-regulated learning.

Although levels of ADHD symptomatology were congruent with data recently published by Mak et al., (2022), past findings suggest a lower prevalence in college students (Weyandt et al., 1995; DuPaul et al., 2001; McKee, 2008). The discrepancy between these data and levels of ADHD symptoms observed in our study might be partially explained by our homogenous sample. For instance, highly neurodiverse students are potentially more interested and therefore might be more prevalent in psychology studies due to their motivation to learn more about their neurodiversity. Also the target population of university students might play a role in the high scores on self-reported ADHD symptoms. That is, the perception of the severity of ADHD symptoms might be increased by academic environments, demanding skills that individuals with ADHD tend to have difficulties with (organisation, motivational drive, etc.). This might result in higher reported levels of ADHD than it would possibly be the case in non-academic environments. This argument is closely related to the common phenomenon of late-identified ADHD, often affecting the population of college students.

Theoretical and Practical Implications

There are some theoretical implications. The finding of a negative relationship between ADHD and SRL is in line with previous evidence, suggesting that the use of self-regulated learning strategies might be lower in the population of students with ADHD (Shelton et al., 2019). While no conclusions about causality can be drawn, theory suggests that ADHD symptoms might impact the use of self-regulated learning strategies negatively. Likewise, the expected finding of a negative relationship between ADHD and SC is consistent with previous research (Willoughby and Evans, 2019; Shelton et al., 2019; Beaton et al., 2020). This is underpinned by theoretical background on the idea that ADHD symptoms affect the maintenance and development of self-compassion negatively through a heightened risk for aversive environments, childhood maltreatment or difficulties with emotional regulation. The result of statistical nonsignificance of the hypothesised relationship between SC and SRL is surprising, considering the existing evidence for a positive link between SC and academic performance. More specifically, self-kindness might increase perception of competence (Neff, 2005), which was found to be a relevant predictor of academic achievement in students with ADHD (Wallace et al. (1999). The reason for the non-significance of this relationship in our sample might be the non-existence of a direct relationship between these variables. However, there is the possibility that a confounding variable (e.g., well-being) cancels out the potential effect of SC on SRL in our sample. For instance, SC might indirectly enhance SRL by positively influencing well-being, which in turn might have a positive effect on SRL. This rationale is congruent with findings from Farmer et al., (2022), suggesting the existence of a direct link between self-compassion and well-being as they found a mediating effect of uncompassionate self-responding in the relation between ADHD and well-being. Further studies found relations between SC and well-being or related factors such as optimism and less worrying (Smeets et al., 2014; Hope et al., 2014). Next to well-being, another factor that potentially impacts the relation between ADHD and SRL is emotion regulation. The relevance of emotion regulation in effects of SC processes is supported by previous studies (Farmer et al., 2022; Paucsik et al., 2022).

Furthermore, emotion regulation can be seen as a key component of self-regulated learning, as it involves the regulation of affective states (Pintrich et al., 1993). Thus, research indicates links of emotion regulation to both variables of interest.

Interpreting our results further, there are practical implications for areas such as developmental psychology and academic support systems. Generally speaking, to foster self-regulated learning from an early age on, educators could receive specialised training on creating a learning environment based on clear instructions, while allowing for autonomy and encouraging functional internal orientations (e.g., task mastery appraisals). For students with ADHD, this might help to prevent future disabilities in academia. Targeting ADHD at the university directly, academic support systems could integrate SRL-interventions in their existing programs in the forms of workshops, group sessions or individual counselling. Despite not finding a significant relation between SC and SRL, our findings support the large body of data showing that self-compassion tends to be significantly low in university students with ADHD. This is concerning as research consistently highlights the importance of self-compassion for well-being. Thus, the practice of SC might be a potential treatment area to improve overall well-being of individuals with ADHD in academia.

Conclusion

This study is the first to shed light on the relationship between ADHD, self-compassion and self-regulated learning in the university student population. We hypothesised and found evidence supporting a negative association between ADHD symptoms and the use of SRL strategies, as well as a negative association between ADHD symptoms and SC. No significant relation between SC and SRL use was observed. Furthermore, our results did not indicate that SC mediates or moderates the relationship between ADHD and SRL use. Despite limited generalizability to the population of university students and potential bias through self-report measures, our findings of significant relations are supported by a substantial accumulation of past evidence and provide theoretical implications for understanding the interplay between ADHD, SC and SRL. Past evidence suggesting the

potential impact of alternative mediators such as well-being and emotion regulation is discussed. Overall, future research is needed for deepening the understanding of the dynamics underlying academic disabilities of students with ADHD symptoms.

References

Advokat, C., Lane, S. M., & Luo, C. (2011). College Students With and Without ADHD: Comparison of Self-Report of Medication Usage, Study Habits, and Academic Achievement. *Journal of Attention Disorders*, *15*(8), 656–666. https://doi.org/10.1177/1087054710371168

Akin, A. (n.d.). Self-compassion and Achievement Goals: A Structural Equation Modeling Approach. *Eurasian Journal of Educational Research*.

Allen, A. B., Goldwasser, E. R., & Leary, M. R. (2012). Self-Compassion and Well-being among Older Adults. *Self and identity : the journal of the International Society for Self and Identity*, *11*(4), 428–453. https://doi.org/10.1080/15298868.2011.595082

Beaton, D. M., Sirois, F., & Milne, E. (2020). Self-compassion and Perceived Criticism in Adults with Attention Deficit Hyperactivity Disorder (ADHD). *Mindfulness*, *11*(11), 2506–2518. https://doi.org/10.1007/s12671-020-01464-w

Breines, J. G., & Chen, S. (n.d.). Self-Compassion Increases Self-Improvement Motivation. *Personality and Social Psychology Bulletin*.

Briscoe-Smith, A. M., & Hinshaw, S. P. (2006). Linkages between child abuse and attention-deficit/hyperactivity disorder in girls: Behavioral and social correlates. *Child Abuse & Neglect*, *30*(11), 1239–1255. https://doi.org/10.1016/j.chiabu.2006.04.008

Canu, W. H., Newman, M. L., Morrow, T. L., & Pope, D. L. W. (2008). Social Appraisal of Adult ADHD: Stigma and Influences of the Beholder's Big Five Personality Traits. *Journal of Attention Disorders*, *11*(6), 700–710. https://doi.org/10.1177/1087054707305090

Capusan, A. J., Kuja-Halkola, R., Bendtsen, P., Viding, E., McCrory, E., Marteinsdottir, I., & Larsson, H. (2016). Childhood maltreatment and attention deficit hyperactivity disorder symptoms in adults: a large twin study. *Psychological medicine*, *46*(12), 2637–2646. https://doi.org/10.1017/S0033291716001021

Coghill, D., & Sonuga, B. E. J. S. (2012). Annual Research Review: Categories versus dimensions in the classification and conceptualisation of child and adolescent mental disorders – implications of recent empirical study. *Journal of Child Psychology and Psychiatry*, *53*(5), 469–489. https://doi-org.proxy-ub.rug.nl/10.1111/j.1469-7610.2011.02511.x

Duncan, T., & McKeachie, W. J. (2005). The making of the Motivated Strategies for Learning questionnaire. *Educational Psychologist*, *40*(2), 117–128. https://doi.org/10.1207/s15326985ep4002_6

DuPaul, G. J., Weyandt, L. L., O'Dell, S. M., & Varejao, M. (2009). College students with ADHD: Current status and future directions. *Journal of attention disorders*, *13*(3), 234-250.

Dweck, C. S. (2013). *Self-theories: Their role in motivation, personality, and development*. Psychology press. https://doi.org/10.4324/9781315783048

Erhardt, D., & Sparrow, E. (1999). The reliability and validity of the Connor-Davidson Scale (CAARS) in a college population [Abstract]. Poster session presented at the annual meeting of the American Psychological Association, Boston, MA.

Farmer, G. M., Ohan, J. L., Finlay-Jones, A. L., & Bayliss, D. M. (2023). Well-being and Distress in University Students with ADHD Traits: the Mediating Roles of Self-Compassion and Emotion Regulation Difficulties. *Mindfulness*, *14*(2), 448-459. https://doi.org/10.1007/s12671-022-02051-x

Garner, J. K. (2009). Conceptualizing the Relations Between Executive Functions and Self-Regulated Learning. *The Journal of Psychology*, *143*(4), 405–426. https://doi.org/10.3200/JRLP.143.4.405-426

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford Press.

Heiligenstein, E., Guenther, G., Levy, A., Savino, F., & Fulwiler, J. (1999). Psychological and academic functioning in college students with attention deficit hyperactivity disorder. *Journal of American college health*, *47*(4), 181-185. https://doi.org/10.1080/07448489909595644

Henning, C., Summerfeldt, L. J., & Parker, J. D. A. (2022). ADHD and Academic Success in University Students: The Important Role of Impaired Attention. *Journal of attention disorders*, *26*(6), 893–901. https://doi.org/10.1177/10870547211036758

He, Q., & Li, J. J. (2022). A Gene-Environment Interaction Study of Polygenic Scores and Maltreatment on Childhood ADHD. *Research on child and adolescent psychopathology*, *50*(3), 309–319. https://doi.org/10.1007/s10802-021-00873-2

Hilpert, J. C., Stempien, J. A., Van Der Hoeven Kraft, K. J., & Husman, J. (2013). Evidence for the latent factor structure of the MSLQ. *SAGE Open*, *3*(4), 215824401351030. https://doi.org/10.1177/2158244013510305

Hope, N., Koestner, R., & Milyavskaya, M. (2014). The Role of Self-Compassion in Goal Pursuit and Well-Being Among University Freshmen. *Self and Identity*, *13*(5), 579–593. https://doi.org/10.1080/15298868.2014.889032

Hoza, B. (2007). Peer Functioning in Children With ADHD. *Journal of Pediatric Psychology*, *32*(6), 655–663. https://doi.org/10.1093/jpepsy/jsm024

Kawamoto, A., Sheth, R., Yang, M., Demps, L., & Sevig, T. (2023). The Role of Self-Compassion Among Adaptive and Maladaptive Perfectionists in University Students. *The Counseling Psychologist*, *51*(1), 113–144. https://doi.org/10.1177/00110000221129606

Kutner, M. H., Nachtsheim, C. J., Neter, J., & Li, W. (2005). *Applied Linear Statistical Models* (5th ed.). McGraw-Hill.

Lefler, E. K., Flory, K., Canu, W. H., Willcutt, E. G., & Hartung, C. M. (2021). Unique considerations in the assessment of ADHD in college students. *Journal of Clinical*

and Experimental Neuropsychology, *43*(4), 352–369. https://doi.org/10.1080/13803395.2021.1936462

Lewandowski, L. J., Lovett, B. J., Parolin, R., Gordon, M., & Codding, R. S. (2007). Extended Time Accommodations and the Mathematics Performance of Students With and Without ADHD. *Journal of Psychoeducational Assessment*, *25*(1), 17-28. https://doi.org/10.1177/0734282906291961

Mak, A. D. P., Lee, S., Sampson, N. A., Albor, Y., Alonso, J., Auerbach, R. P., Baumeister, H., Benjet, C., Bruffaerts, R., Cuijpers, P., Ebert, D. D., Gutierrez-Garcia, R. A., Hasking, P., Lapsley, C., Lochner, C., & Kessler, R. C. (2022). ADHD Comorbidity Structure and Impairment: Results of the WHO World Mental Health Surveys International College Student Project (WMH-ICS). *Journal of attention disorders*, *26*(8), 1078–1096. https://doi.org/10.1177/10870547211057275

McKee, T. E. (2008). Comparison of a norm-based versus criterion-based approach to measuring ADHD symptomatology in college students. *Journal of Attention Disorders*, *11*(6), 677-688.

Neff, K. D. (2003). The Development and Validation of a Scale to Measure Self-Compassion. *Self and Identity*, *2*(3), 223–250. https://doi.org/10.1080/15298860309027

Neff, K. (2003). Self-Compassion: An Alternative Conceptualization of a Healthy Attitude Toward Oneself. *Self and Identity*, *2*(2), 85–101. https://doi.org/10.1080/15298860309032

Neff, K. D., Hsieh, Y.-P., & Dejitterat, K. (2005). Self-compassion, Achievement Goals, and Coping with Academic Failure. *Self and Identity*, *4*(3), 263–287. https://doi.org/10.1080/13576500444000317

Neff, K. D., & Pommier, E. (2013). The Relationship between Self-compassion and Other-focused Concern among College Undergraduates, Community Adults, and Practicing Meditators. *Self and Identity*, *12*(2), 160–176. https://doi.org/10.1080/15298868.2011.649546

Paucsik, M., Nardelli, C., Bortolon, C., Shankland, R., Leys, C., & Baeyens, C. (2023). Self-compassion and emotion regulation: testing a mediation model. Cognition & emotion, 37(1), 49–61. https://doi.org/10.1080/02699931.2022.2143328

Pintrich, P. R. (1995). Understanding self-regulated learning. *New Directions for Teaching and Learning*, *1995*(63), 3–12. https://doi.org/10.1002/tl.37219956304

Psychogiou, L., Daley, D.M., Thompson, M.J. *et al.* Mothers' expressed emotion toward their school-aged sons. *Eur Child Adolesc Psychiatry* **16**, 458–464 (2007). https://doi.org/10.1007/s00787-007-0619-y

Ratanatharathorn, A., Koenen, K.C., Chibnik, L.B. *et al.* Polygenic risk for autism, attention-deficit hyperactivity disorder, schizophrenia, major depressive disorder, and neuroticism is associated with the experience of childhood abuse. *Mol Psychiatry* 26, 1696–1705 (2021). https://doi.org/10.1038/s41380-020-00996-w

Reaser, A., Prevatt, F., Petscher, Y., & Proctor, B. (2007). The learning and study strategies of college students with ADHD. *Psychology in the Schools*, *44*(6), 627–638. https://doi.org/10.1002/pits.20252

Sanderud, K., Murphy, S., & Elklit, A. (2016). Child maltreatment and ADHD symptoms in a sample of young adults. *European journal of psychotraumatology*, *7*, 32061. https://doi.org/10.3402/ejpt.v7.32061

Sedgwick-Müller, J. A., Müller-Sedgwick, U., Adamou, M., Catani, M., Champ, R., Gudjónsson, G., Hank, D., Pitts, M., Young, S., & Asherson, P. (2022). University students with attention deficit hyperactivity disorder (ADHD): a consensus statement from the UK Adult ADHD Network (UKAAN). *BMC psychiatry*, *22*(1), 292. https://doi.org/10.1186/s12888-022-03898-z

Shelton, C. R., Addison, W. E., & Hartung, C. M. (2019). ADHD and SCT Symptomatology in Relation to College Students' Use of Self-Regulated Learning Strategies. *Journal of Attention Disorders*, *23*(14), 1719–1728. https://doi.org/10.1177/1087054717691134

Simmons, S. P., & Antshel, K. M. (2020). Predicting adaptive functioning in adults with ADHD: The roles of childhood maltreatment, executive functions, and emotion dysregulation. Journal of Attention Disorders, 24(13), 1822-1833.

Suhr, J. A., Weiss, L. M., Kellison, I. L., & Takane, Y. (2010). An evaluation of the Connor-Davidson scales: Continuous performance test and infrequency index to detect simulated attention deficits. Assessment, 17(3), 368-376.

Tellings, A. (2020). Diagnosis pressure and false positives: Toward a non-reductionist, polytomic approach of child mental problems. *Philosophical Psychology*, *33*(1), 86–101. https://doi.org/10.1080/09515089.2019.1698021

Wallace, B. A., Winsler, A., & NeSmith, P. (1999). Factors Associated with Success for College Students with ADHD: Are Standard Accommodations Helping?.

Wang, J., Zuo, Z., Wang, Y., & Liu, H. (2020). Childhood maltreatment and self-compassion: A systematic review and meta-analysis. Child Abuse & Neglect, 104

Werner, K. H., Jazaieri, H., Goldin, P. R., Ziv, M., Heimberg, R. G., & Gross, J. J. (2012). Self-compassion and social anxiety disorder. *Anxiety, stress, and coping*, *25*(5), 543–558. https://doi.org/10.1080/10615806.2011.60884

Weyandt, L. L., & DuPaul, G. (2006). ADHD in College Students. *Journal of Attention Disorders*, *10*(1), 9–19. https://doi.org/10.1177/1087054705286061

Weyandt, L. L., & DuPaul, G. J. (2008). ADHD in college students: Developmental findings. *Developmental disabilities research reviews*, *14*(4), 311-319. https://doi.org/10.1002/ddrr.38

Wolf, L. E. (2001). College students with ADHD and other hidden disabilities: Outcomes and interventions. *Annals of the New York Academy of Sciences*, *931*(1), 385-395.

Wolf, L. E., Simkowitz, P., & Carlson, H. (2009). College students with attention-deficit/hyperactivity disorder. *Current psychiatry reports*, *11*(5), 415-421.

Wolters, C. A., Shirley, L. Y., & Pintrich, P. R. (1996). The relation between goal orientation and students' motivational beliefs and self-regulated learning. *Learning and individual differences*, *8*(3), 211-238. https://doi.org/10.1016/S1041-6080(96)90015-1

Zhang, H., Li, J., Sun, B., & Wei, Q. (2023). Effects of Childhood Maltreatment on Self-Compassion: A Systematic Review and Meta-Analysis. *Trauma, violence & abuse*, *24*(2), 873–885. https://doi.org/10.1177/15248380211043825

Appendix

Assumption Check

To test our hypotheses we considered assumptions for linear and multiple regression analysis, that is normality, linearity, homoscedasticity, independence and the variance inflation factor (VIF) for excluding multicollinearity. The assumption of normality was tested by using Q-Q plot models (Figure 1, Figure 2, Figure 3), revealing that the data is approximately normally distributed. Scatterplots with standardised residuals confirmed that both the homoscedasticity and linearity assumptions are met (Figure 4, Figure 5) and according to the Durbin Watson test, our data consists of solely independent observations (Durbin-Watson: 2.034). Furthermore, the variance inflation factor equals 1.075 with a tolerance of 0.93, indicating no violation of the assumption of low multicollinearity (Kutner et al., 2005).

Figure 1

Normal Q-Q Plot of the residuals of the CAARS DSM Total scale

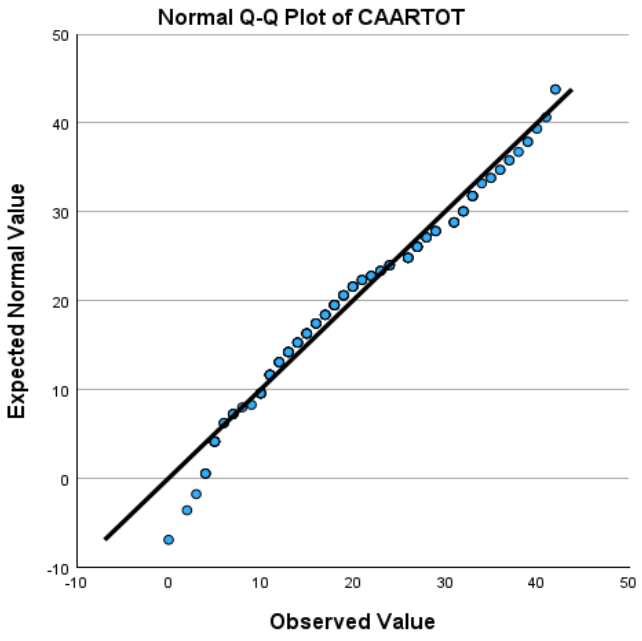


Figure 2

Normal Q-Q Plot of the residuals of the SCS

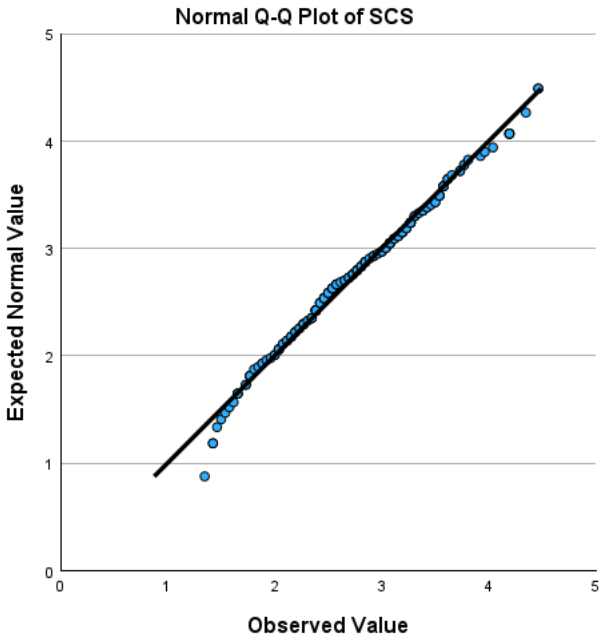


Figure 3

Normal Q-Q Plot of the residuals of the MSLQ

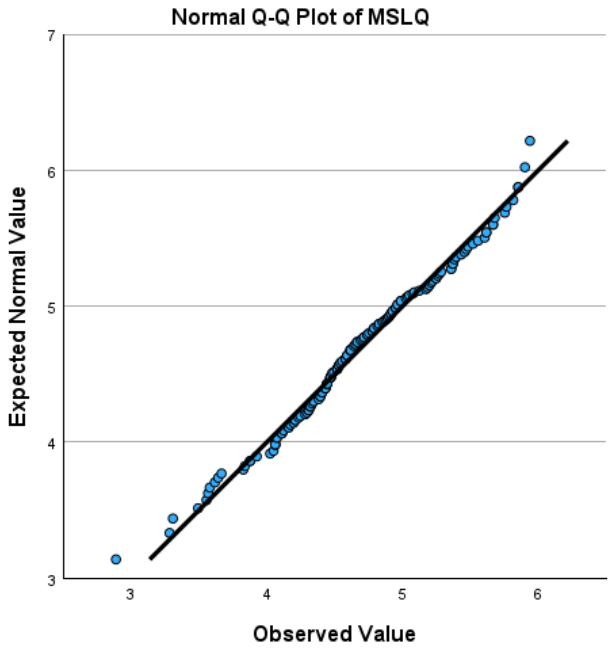


Figure 4

Scatterplot of the residuals of the predictor CAARS DSM Total scale

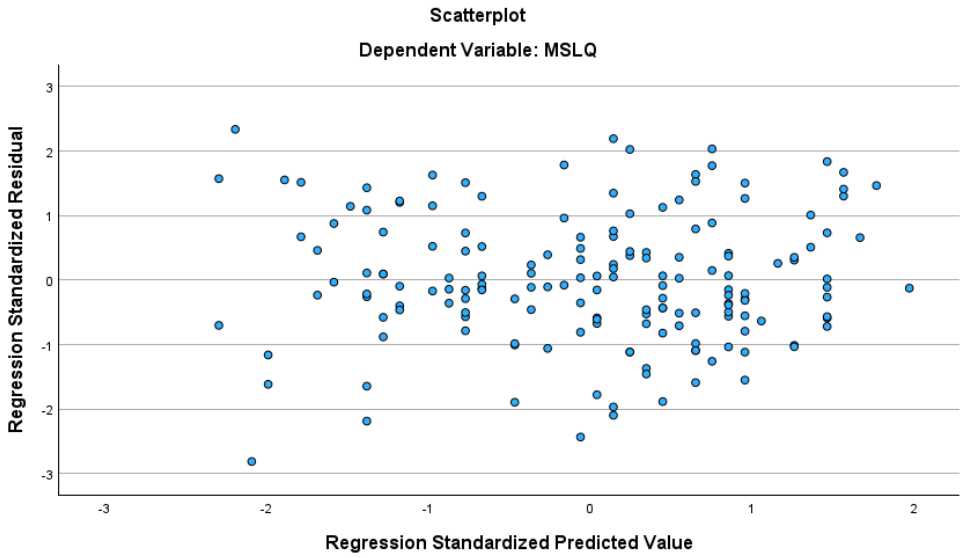


Figure 5

Scatterplot of the residuals of the predictor SCS