Task Preparation and Effort Allocation in University Students with Varying Levels of ADHD Symptoms

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Abstract

This paper investigates the effect of gender and levels of ADHD symptomatology on reactive cognitive control in university students. Reactive cognitive control being engaged in response to a stimulus with no preparation prior to its occurrence. This process was measured in this study by use of a Stroop task with two conditions. A condition with a cue before the occurrence of the stimulus (alerting) and one without (no-cue). The no-cue condition measured reactive cognitive control, while the alerting condition functioned as a control condition. Forty-nine college students participated in the study as part of the SONA program of the Rijksuniversiteit Groningen. The two main questions this paper is trying to answer are if there is an effect of varying degrees of ADHD symptomatology on a participant's engagement of reactive cognitive control and if there is an effect of a participant's gender on their engagement of reactive cognitive control. In the data analysis two repeated measures ANOVA with the between-subjects factors gender and self-reported level of ADHD symptomatology were performed. The data analysis found no significant effect for gender or level of ADHD symptomatology on the reaction times of the college students with ADHD during the Stroop task. It can be concluded that gender has no effect on reactive cognitive control. The findings on ADHD symptomatology should be disregarded due to the limitations of the sample, for example the small number of participants with high levels of ADHD symptoms and the varying environments in which the participants took part in the experiment.

Keywords: ADHD, reactive cognitive control, gender differences

The Effect of ADHD and Gender on Reactive Cognitive Control in College Students

ADHD or attention deficit hyperactivity disorder is defined as behavioral disorder with common symptoms of inattention, impulsivity and hyperactivity (American Psychiatric Association (APA), 2000). ADHD is most common in children, with up to 9%-10% of children showing symptoms (Danielson et al., 2018), but in some cases, it is carried on into adulthood. This is often disregarded, as in the public mind ADHD is seen as an impairment only affecting children. Which explains why only 10%-25% of adults with ADHD get diagnosed (Castel et al., 2007). In a 2000 estimate by the American Psychiatric Association (American Psychiatric Association (APA), 2000), 3%-7% of college students were experiencing ADHD symptoms. ADHD has been found to impair cognitive control (Zhu et al., 2021). The first question this paper will address is how varying levels of ADHD affect reactive cognitive control in college students. It will further extend this research by asking how gender affects reactive cognitive control in students with ADHD. The concept of reactive cognitive control will be explained in the following paragraph. Little research has been done on reactive cognitive control in students with ADHD and the interplay with gender, this paper will try to address that gap in the research.

Cognitive Control in ADHD

There are many executive functions that make up our conscious behavior while taking into account our surroundings and environment. Dorr and Armstrong (2018) show in their study on impairment of executive functions in college students with ADHD, that ADHD symptomatology positively predicts impairment. The notion of a negative relationship between self-reported strength of symptoms and executive functions is also supported by Salomone et al. (2016) and Krieger et al. (2020). One subgroup in these executive functions consists of reactive and proactive cognitive control. These processes are activated in order to initiate a response to a stimulus. Proactive cognitive control is initiated in the anticipation of a stimulus, preparing us to react. The process this paper's main focus is on is reactive cognitive control, which is initiated after, so as direct response to, a stimulus. This reactive cognitive control has been shown to be negatively affected by ADHD (Lijffijt et al. 2005; Pani et al., 2013). ADHD has been shown to cause a lack of response inhibition and a deficiency in inhibitory motor control (Oosterlaan et al., 1998). This causes people with ADHD to have slower reaction times during tasks requiring them to react as fast as possible to a stimulus, when compared to a control group without ADHD (Lijffijt et al., 2005). This is further supported by a study on reactive and proactive cognitive control in children, which found reactive cognitive control especially to be impaired by ADHD and found no impairment in proactive cognitive control (Pani et al., 2013). The children performed significantly worse at a task requiring reactive cognitive control than a control group without ADHD, while there was no significant difference in the performance of children with ADHD compared to children without it at a task requiring proactive control. This finding is supported by a study on preschoolers by Jarrett et al. (2015), which found less effective engagement of reactive cognitive control processes to predict hyperactivity symptoms. A study by Grane et al. (2016) further found electrophysiological evidence of impairment of reactive cognitive control in adults with ADHD. They showed less efficient engagement of reactive control compared to a healthy control group during a Go/NoGo task.

To summarize, reactive cognitive control has been found to be negatively affected by ADHD in the past. It causes impairments in response inhibition and inhibitory motor control, causing worse performances at reaction time tasks compared to control groups. This was found by several different studies, showing high convergent validity. Proactive control has not been found to be significantly impaired in children with ADHD, unlike reactive cognitive control which has been found to be impaired. In our experiment it will be assessed whether these findings of impairments of reactive cognitive control translate into the context of college students with varying ADHD symptomatology.

Gender Differences in Cognitive Control and ADHD

The proportions of males and females with ADHD seem to be stable across all ages, according to Ramtekkar et al. (2010). ADHD, in its early on-set at least, is more common in men than in women, a study by Danielson et al. (2018) found 12.9% of boys suffering from symptoms in comparison to 5.6% of girls. Ramtekkar et al. (2010) found similar percentages, however their findings also suggested that females are sometimes not diagnosed correctly, meaning the percentage gap between men and women with ADHD might not be as big as initially indicated. This is supported by Rucklidge (2010) who raised a similar point and also by Mörstedt et al. (2015), who found that men tend to rate their hyperactivity symptoms higher than females. A meta-analysis by Gershon (2002) analyzing gender differences in children, adolescents and adults with ADHD found males to suffer from higher levels of ADHD symptomatology, especially hyperactivity, than females. Females however suffered from greater intellectual impairments compared to males. Higher symptomatology in males is also mentioned as a possible cause for the findings of Lipszyc and Schachar (2010), who found in their meta-analysis of studies using the Stop-task, an experiment testing for reactive cognitive control in the participants, a higher reaction time for males with ADHD than females with ADHD. Meanwhile, in a different study investigating gender differences in cognitive control, males without ADHD were found to perform better at tasks requiring reactive cognitive control than females without ADHD (Bianco et al., 2019). Females performed better at tasks requiring proactive cognitive control. These findings indicate that there is indeed a gender difference in reactive cognitive control in males and females with and without ADHD. ADHD seems to affect this gender difference as the meta-analysis by

Lipszyc and Schachar (2010) found males to perform worse and the study by Bianco et al. (2019) found males to perform better at tasks requiring reactive cognitive control. It should be noted here that little research has been done on the interplay between ADHD symptomatology, gender and reactive cognitive control specifically. Gender differences in ADHD and reactive cognitive control associated with ADHD have been thoroughly researched by themselves, but not as often in combination, explaining the low number of studies cited for this topic in the review of the literature. This study therefore gives a valuable contribution to filling this gap in the research.

To summarize, men and women differ in ADHD symptomatology, with males seemingly having higher levels of symptomatology more often. There are also indications that they differ in performance when it comes to tasks requiring reactive cognitive control. Studying these gender differences is relevant, for example to advance the development of measures used to accommodate students with ADHD and thereby create more equal academic opportunities for them.

The Present Study

In the review of the literature few studies testing specifically gender differences in reactive cognitive control in college students with ADHD were found. The goal of this study is to fill that gap in the research and to answer the following questions:

1. What is the effect of differing levels of ADHD symptomatology on the engagement of reactive cognitive control in university students?
2. How does gender affect the engagement of reactive cognitive control in university students with differing levels of ADHD symptomatology?

To answer these questions, the participants were asked to participate in a Stroop task. The Stroop task is often used to measure reactive cognitive control, as can be seen in studies by Yang, Miskovich and Larsen (2018) and Bugg (2014). During the task the participants were asked to indicate the color of words, which had a meaning congruent or incongruent to the color. For example, the word red, colored in red, would be congruent. These words were presented in three different conditions, with a cue as to whether or not the word would be congruent ahead of the presentation, with a simple alerting cue before the presentation and with no cue at all. Furthermore, these different conditions were also presented in three different event rate conditions, slow, medium and fast. In the analysis of the data this paper will focus on comparing the non-cued condition, which requires reactive cognitive control and the alerting condition as a control condition. Using the data collected from this experiment this paper will test the following hypotheses:

Hypothesis 1: College students with higher levels of ADHD symptoms have a less effective engagement of reactive cognitive control (higher reaction times (RT) for the non-cued condition) compared to students with lower levels of ADHD symptoms. (Lijffijt et al., 2005).

Hypothesis 2: Female college students with ADHD perform better than male college students with ADHD at tasks requiring reactive cognitive control (higher reaction times (RT) for the non-cued condition) (Gershon, 2002).

Methods

Participants

A total of 49 students participated in this experiment as part of a convenience sample pooled from the SONA research program of the University of Groningen. The collected sample consisted of 20 males and 29 females with an average age of 20 (M = 20, SD = 2.13). Female participants scored M = 48.1(SD = 9.4) and male participants M = 51.3(SD = 11) on the questionnaire of the CAARS. Of three students, one female and two male participants had a self-reported ADHD diagnosis, 14 participants reported either suffering from anxiety, depression or stress disorder, three stated dyslexia, and one person reported having a motor disorder. After further investigation, the participant's diagnosis of motor disorder was disregarded due to inconsistencies in the self-report of mental disorders. Two participants reported currently taking Methylphenidate and Sertraline. Of our sample, 31 participants did not indicate a prior clinical diagnosis. Visual impairments, like far-sightedness, were not accounted for in the experiment. Participation was voluntary, and participants were compensated for participating in this experiment by being awarded SONA points, necessary to pass the first year of Bachelor of Science in Psychology.

Apparatus

The participants completed the study online using a device of their choice and opened the link to the experiment through a web browser, also of their own choice. The participants were required to have internet access to take part in the reaction time task. OpenSesame Version 3.2 was used to create the online format of the experiment. Jatos was used to create a host server for the experiment. The specific online version of the CAARS questionnaire was created in Qualtrics in a previous study on ADHD in university students.

Measures

Conners' Adult ADHD Rating Scale Self-Report Long Form

The participants were instructed to complete the Conners' Adult ADHD Rating Scale Self-Report Long Form (CAARS-S:L), a questionnaire relating to the severity of ADHD symptoms. The CAARS is a popular measure to assess ADHD, with an acceptable test-retest reliability and moderate to high sensitivity and specificity to distinguish between individuals with ADHD from control groups (Conners et al., 1999; Erhardt et al., 1999; Van Voorhees et al., 2011). The questionnaire includes 66 items in numerical answer keys (0= not at all, 1= a little, 2= pretty much, 3= very much) and is divided into six sub-categories about statements relating to behavior or tendencies of the participants daily life. The sub-categories include DSM-IV: Hyperactive-Impulsive Symptoms, DSM-IV: Inattentive Symptom, Hyperactivity/Restlessness, Impulsivity/Emotional Lability, Inattention/Memory Problems and Problems with Self-Concept, reflecting ADHD symptoms. Higher scores of the CAARS indicate increasing symptom severity. Values around 50 (*SD* +/- 10) suggest that a participant is in the average range (Conners et al., 1999).

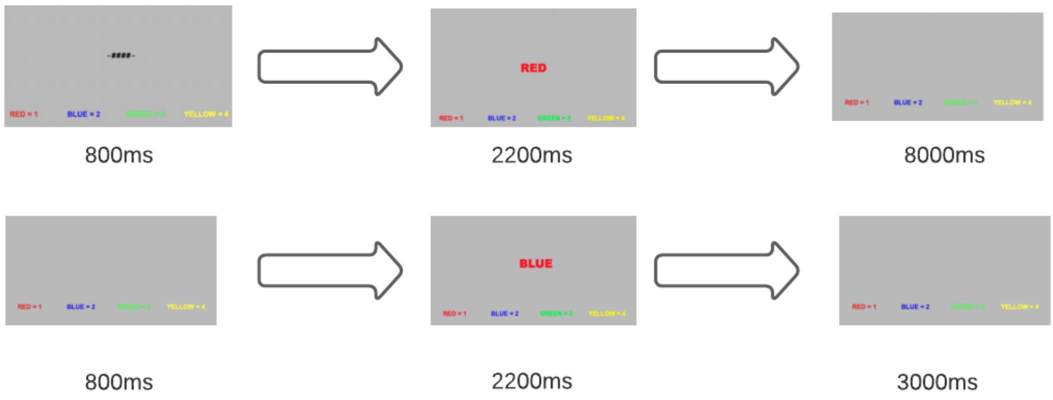
The DSM-IV: ADHD Symptoms Total Scale represents if the individual behaves in a manner consistent with the DSM-IV diagnostic criteria for the combined type of ADHD. The ADHD Index indicates individuals at risk for ADHD. Our dataset analysis used the T-scores of the ADHD Index subscale since it provides information about the risk and severity of ADHD symptomatology and indicates possible subclinical individuals who are at the risk of developing ADHD. This is more beneficial than the ADHD Symptom Total Scale in our analysis because we only have two individuals diagnosed with ADHD in our sample. Observing the risk of developing ADHD is more beneficial in the present research to differentiate between the performance of different risk groups of ADHD.

Stroop Task

In the Stroop Task, the participants were presented with a color name either written in the same ink, like blue written with blue ink, or different, for example, blue written with red ink (Figure 1). Participants were required only to react when the ink and the word were corresponding and to indicate the color of the word shown on the screen, using one of four keys on their computer (1 = red, 2 = blue, 3 = green, 4 = yellow). In this experiment, it was differentiated between three cued-trials, in which the stimulus was presented (Figure 1). The first condition showed the stimuli with no prior information or warning that the stimulus would occur, which can be seen in the first blank picture of Figure 1. We will refer to this condition as the no-cue condition, representative of measuring reactive control. The second condition, the alerting condition, warns the participant before the presentation of the stimulus with the image of four hashtags (-####-), that the stimulus will occur. The third condition reflects the measure of proactive control by including an informed-cue before the trial, informing the participant about the nature of the upcoming trial. The informed-cue condition will be disregarded in the data analysis of this paper, as it focusses on reactive cognitive control. Every cue condition appeared 800ms before the upcoming trial. After that 800 ms, the participants had 2200ms to decide whether the trial was incongruent or congruent. Additionally, the conditions were presented at three different event rates, each with different time periods between the presentation of the stimulus. The three conditions were slow (8000ms seconds between each interval), medium (3000ms seconds between each interval) and fast (500ms seconds between each interval). The slow condition included 60 trials, the medium trial included 110 trials and in the fast condition, 208 trials were presented, making the time needed to complete the slow and medium condition 11 minutes and the time needed for the fast condition 12 minutes.

Figure 1: Time Segments of the Stroop Task

Example sequence of stimulus presentation in the Stroop task



Note: In this image the different time segments of the Stroop task are displayed in milliseconds (ms). The sequence starts with the presentation of the cue (upper sequence: alerting, lower sequence: no-cue), displayed for 800ms. Next the congruent or incongruent stimulus is presented for 2200ms (upper sequence: congruent, lower sequence: incongruent). The sequence ends with a blank image displayed until the presentation of the next cue, the time this blank image is displayed depends on the sequences event rate condition (upper sequence: slow (8000ms), lower sequence: medium (3000ms)).

The experiment was performed by the participants within two separate sessions. Previous to the experiment, a practice round of 14 randomized trials, including six non-cue trials, three alerting and five information-cued trials, was absolved. In the practice trial, the alerting and informational cues occurred 800ms, followed by the stimulus for 2000ms with received feedback on their performance for 2000ms. The experiment consisted of a row of 24 trials in a randomized order, which were repeated in the slow condition for 60 trials, in the medium condition for 110 trials and in the fast condition 208 trials. In total, there were data recorded of 342 trials for the experiment.

Testing Procedure and Research Design

Before participating in the experiment, participants were given an information sheet containing general information about their participation in the experiment, after which they filled out an informed consent form. In the first session, participants were assigned to fill out scales measuring ADHD-related problems, namely the CAARS, the Weiss Functional Impairment Rating Scale (WFIRS) and the Barkley Deficits in Executive Functioning Scale (BDEFS). Data from the WFIRS and BDEFS are not applied in our research due to not every participant answering the questionnaires, resulting in a lack of data and some of the data not being linked with our research goals. The students participating indicated their SONA numbers as means of identification. For identity and privacy protection, these SONA numbers were translated into specific codes. The participants were able to decide whether to begin with the Stroop Task- or a Task-Switching experiment. Data from the Task-Switching was not analyzed in the present study. Between each of the three event rate conditions, the participants had the option to take a break of five minutes, to decrease the risk of fatigue. For each trial, accuracy and reaction were measured. The Stroop Task, including breaks, took approximately 45 minutes to complete. Afterward, the participants were briefed about the purpose of the experiment.

Data analysis

The reaction times of the participants were split into three groups using their scores on the CAARS test. Three of the 49 participants were excluded as they did not participate in the CAARS questionnaire.The between-subjects factor CAARS level indicates whether a participant was sorted into the low, medium or high CAARS level group. Three of the 49 participants were excluded as they did not participate in the CAARS questionnaire. The low group had 16 participants, with a mean t-score of 38.734 and a standard deviation of 3.914. The medium group had 15 participants, with a mean t-score of 50.696 and a standard deviation of 5.112. The high group had 15 participants, with a mean t-score of 59.089 and a standard deviation of 6.946.

With this CAARS level split as a between subjects factor a repeated measures ANOVA testing for reaction times was performed. In this ANOVA the assumption of sphericity was violated, which is why the Greenhouse-Geisser correction was used for the significance level values. The within subjects factors in all ANOVAs performed were the rate at which a new stimulus was presented in the Stroop task (event rate), the cue condition and the congruency of the stimulus. Findings involving event rate are not reported in the results, as they have no relevancy in answering the research questions.

A second ANOVA testing for accuracy was also performed, this was done to account for a possible speed-accuracy tradeoff, so in case a group had significantly faster reaction times but also significantly lower accuracy. This process was repeated with another repeated measures ANOVA testing for reaction times, this time with the between subjects factors gender and CAARS level. Again, the assumption of sphericity was violated, which is why the Greenhouse-Geisser correction was used for the significance level values. And to account for a possible speed-accuracy tradeoff another repeated measures ANOVA testing for accuracy was performed. Furthermore, the validation of the task manipulations was done using the output of the repeated measures ANOVAs. The assumption of homoscedasticity was also violated in both ANOVAs. Despite violations of sphericity and homoscedasticity in our sample, we decided to use parametric tests instead of nonparametric tests. We did so, since repeated measures ANOVA has been shown to be resistant to non-normality in the past (Blanca, Alarcón, Arnau, Bono, & Bendayan, 2017). We also decided against using for example a log-transformation, as transforming the data would impair our ability to compare it to other reaction time studies, since the transformed data does not represent the actual reaction time performance of the participants. Furthermore, transformation would be unlikely to cause better type-one error reduction and higher statistical power in our data analysis (Schramm & Rouder, 2019).

Results

Table 1: Mean Reaction Time at Different CAARS Levels

Mean reaction times and standard deviation for the no-cue and alerting condition at each CAARS level

CAARS Level	No-cue		Alerting	
	Congruent	Incongruent	Congruent	Incongruent
Low	789.4	855.5	725.7	783.4
	(268)	(263)	(221)	(265.6)
Medium	737.7	803.4	680.6	730.2
	(129.1)	(165.1)	(136.3)	(146.3)
High	696.8	743.4	651.2	692.5
	(117.3)	(129.9)	(108.1)	(114)

Note: In this table mean reaction time and standard deviation are displayed in milliseconds (ms) for the no-cue and alerting condition. The upper value is the mean reaction time and the value in brackets below is the standard deviation. Low, medium and high horizontally give the CAARS score of the participant group (CAARS level), indicating level of ADHD symptomatology.

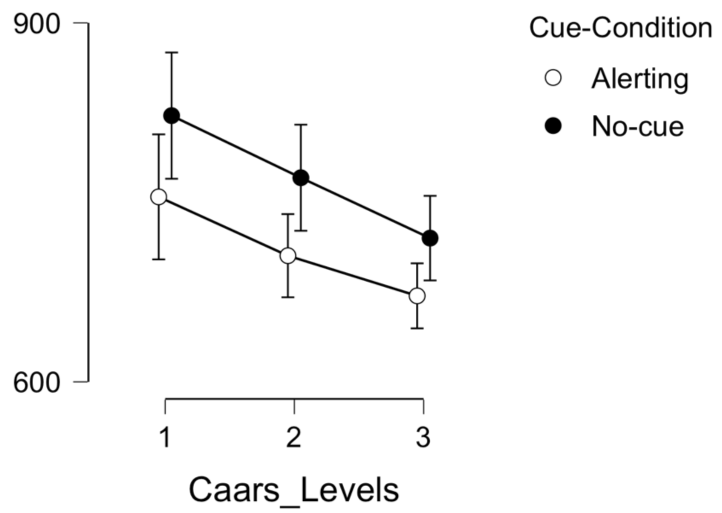
Hypothesis 1: The Effect of ADHD Symptoms on Reactive Cognitive Control

In the repeated measures ANOVA with CAARS level as a between-subjects factor cue-condition with F (1, 43) = 89.448, $p < .001$, MSE = 5628.247, $\eta^2 = 0.022$ and congruency with F (1, 43) = 50.342, $p < .001$, MSE = 8139.043, $\eta^2 = .018$ were significant. This validates our task manipulations. CAARS level as a factor was not found to be significant with F (2, 43) = 1.776, $p = .181$, MSE = 225072.286, $\eta^2 = .076$. Neither was the interaction effect between CAARS level and condition with F (2, 43) = .92, $p = .406$, MSE = 5628.247, $\eta^2 = .00$.

In the repeated measures ANOVA testing for accuracy in the Stroop task trials, CAARS level and the interaction between CAARS level and condition were also not found to be significant. A possible speed-accuracy tradeoff has therefore been accounted for.

Figure 2: Cue-Condition Means at Varying CAARS Levels

Mean and confidence interval for CAARS levels low, medium and high for the alerting and no-cue conditions respectively.



Note: In this figure the mean reaction times of the three CAARS levels, low(1), medium(2) and high(3) are displayed in milliseconds (ms) for both the no-cue and the alerting control condition. For each mean a 95% confidence interval is given.

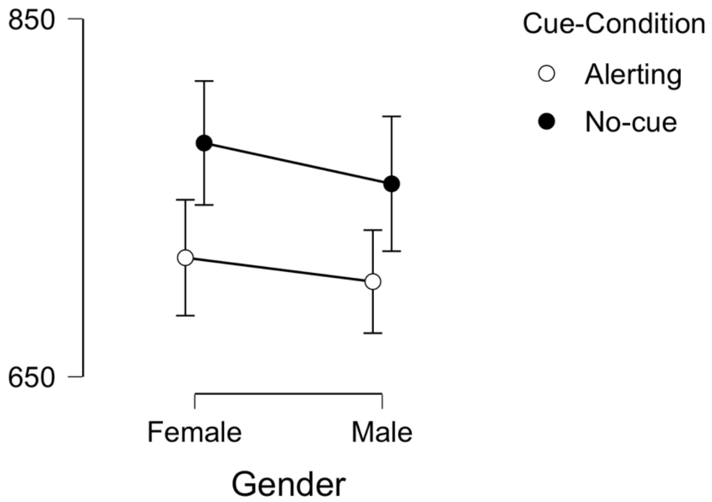
Hypothesis 2: Gender Differences in Reactive Cognitive Control in University Students with ADHD Symptoms

In the repeated measures with the between-subjects factor gender and CAARS level cue-condition with F (1, 40) = 75.666, p < .001, MSE = 5868.329, η^2 = .02 and congruency with F (1, 40) = 46.999, p < .001, MSE = 8370.069, η^2 = .018 were significant. This validates our task manipulations. Gender as a between-subjects factor was not found to be significant with F (1, 40) = .003, p = .96, MSE = 239074.029, η^2 = .00. The interaction effect between gender, CAARS level and condition was also not found to be significant with $F(2, 40) = .495$, $p = .613$, $MSE = 5868.329$, $\eta^2 = .00$.

The repeated measures ANOVA testing for accuracy in the Stroop task trials, gender and the interaction between gender, CAARS level and condition were again not found to be significant. These findings indicate that no speed-accuracy tradeoff occurred.

Figure 3: Cue-Condition Means Split by Gender

Mean and confidence interval for males and females for the alerting and no-cue conditions respectively.



Note: In this figure the mean reaction times of males and females are displayed in milliseconds (ms) for both the no-cue and the alerting control condition. For each mean a 95% confidence interval is given.

Discussion

The goal of this study was to gain insights into the effect of varying levels of ADHD symptomatology on reactive cognitive control in university students and to find out if gender affects reactive cognitive control in university students with varying levels of ADHD. The combination of gender, reactive cognitive control and ADHD symptoms has so far not been in the scope of researchers, meaning little research has been done on it. Filling this gap in the research is relevant as its findings could contribute to better accommodation of students with ADHD in academic settings.

Hypothesis 1: The Effect of ADHD Symptoms on Reactive Cognitive Control

The participants score on the CAARS test does not seem to significantly affect their reaction times during the Stroop task in the no-cue condition. It was also controlled for accuracy, which was also not affected by CAARS level. This opposes the findings of past research such as Lijffijt et al. (2005) and Pani et al. (2013), who found reactive cognitive control to be significantly impaired by ADHD. Or Jarrett et al. (2015) and Grane et al. (2016), who clearly linked ADHD symptoms to less efficient engagement of reactive cognitive control. So why do the results of the data analysis paint a different image? An interesting finding is the difference in mean reaction time when split by CAARS levels. This paper tries to assess whether college students with higher levels of ADHD symptoms perform worse at the no-cue condition than college students with lower levels of ADHD. However, the opposite can be deducted from the findings of the data analysis. The mean reaction times of the no-cue condition are highest for college students with a low CAARS score in the fast and medium condition and college students with a medium CAARS score for the slow condition (Table 1). Even though this difference is not significant, on the surface one would now think that ADHD symptoms lead to better reactive cognitive control. It is very unlikely that this is the case because reactive cognitive control has been shown to be negatively affected by ADHD in several studies in the past (Lijffijt et al., 2005; Pani et al., 2013; Jarrett et al., 2015; Grane et al., 2016). These contrasting results can be explained by the way the CAARS scale was used in this study. Only two of the participants had a CAARS score higher than 70 and were therefore at risk of having ADHD. Therefore, three equal sized groups were created, as described in the method section. The mean of the CAARS is 50 which represents the average person, who is not at risk of having ADHD. So even though the means of the medium CAARS score group and the low CAARS score group differ, the medium group is not necessarily at higher risk of having ADHD. This limitation of the study is due to the small sample size and the lack of participants with high levels of ADHD symptomatology. The finding that there is no significant difference between the performance of people with more ADHD symptoms and people with less symptoms should therefore be disregarded. In future studies larger sample sizes should be used with equal shares of participants with CAARS scores around or below 50 and participants with CAARS scores around or above 70.

Hypothesis 2: Gender Differences in Reactive Cognitive Control in University Students

The data analysis also found gender to have no significant effect on the reaction times or the accuracy of the participants. This would theoretically mean that males and females do not differ in reactive cognitive control. This opposes the findings of past research that found a significant difference in performance between males and females with ADHD (Lipszyc & Schachar, 2010). Further research needs to investigate this, possibly with larger sample sizes than this study. Future studies should consider the use of a control group to investigate whether gender difference in reactive cognitive control is significantly affected by ADHD, as the meta-analysis by Lipszyc and Schachar (2010) would indicate.

Limitations

The participant pool of this study consists of a convenience sample of university students this has some advantages but also limits the applicability of the results, resulting in low overall external validity. An advantage of using this kind of sample is that it is very applicable to this very specific group of people that all have very similar ages and educational backgrounds. Furthermore, because we used a non-clinical sample, we had the possibility to apply a dimensional approach to ADHD symptoms. This allowed us to cover a wider range of cases and not just ones with severe symptomatology, as is often the case when comparing a clinical sample to a control group.

As previously discussed however, the way the CAARS questionnaire was used limited the external validity of the study as the categories are not representative of individuals with low, medium and high levels of ADHD symptomatology. This was due to a small sample size and a lack of participants with a high score on the CAARS questionnaire.

Another limiting factor is the varying environments in which the experiment was conducted by the participants. Since every participant took part in the experiment using their own devices and no specifics were given as to where to conduct the experiment, factors such as noise, lighting and distracting factors can vary to unknown degree. Future studies should consider providing the participants with a controlled environment to complete the experiment in. A further weakness of this study is the relatively low effect size for most of the significant effects in the repeated measures.

Conclusion

To conclude, in this study gender and level of ADHD symptomatology were found to not significantly affect reaction times during a task requiring reactive cognitive control. While these findings are statistically sound the limitations of the study especially in terms of its small convenience sample should be considered. The findings on ADHD symptomatology should be mostly disregarded due to this limitation. Future studies should employ the use of larger sample sizes and higher ADHD-symptom sample variety.

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