UNIVERSITY OF TWENTE.

Bachelorthesis

Psychology PPT

The Relationship between Cognitive Enhancement Drug Use and Self-Efficacy: The mediating Effect of Stress.

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Abstract

Background: Over the last several years studies show an alarming trend in the field of Cognitive Enhancement drugs. Studies mainly conducted in the U.S. and Great Britain showed that more and more people, especially students, are prone to enhance their cognitive ability by using drugs. It was also shown, that stress seems to be a predictor of Cognitive Enhancement drug use. Since, on the other hand, low self-efficacy was also found to be a predictor for higher levels of stress, those three constructs were combined in a conceptual model in this study. The aim of this study was to examine whether stress has a mediating effect on the relationship between self-efficacy and Cognitive Enhancement drug use.

Method**:** In a cross-sectional online survey-based study design, the relationship between self-efficacy, level of stress and Cognitive Enhancement drug use was examined. A sample of 175 university students was recruited via convenience sampling. The participants were asked to complete an online survey reporting their perceived level of self-efficacy, stress and items regarding the frequency of Cognitive Enhancement drug use.

Results: The results indicated that higher levels of self-efficacy were associated with lower levels of stress. In contrast, there was no relationship found between Cognitive Enhancement drug use and either self-efficacy or level of stress. Stress was thus not found to have a mediating effect on the relationship between self-efficacy and Cognitive Enhancement drug use.

Conclusion*:* The results did not provide any support for the proposed relationship between self-efficacy, level of stress and Cognitive Enhancement drug use. Nonetheless, a significant negative relationship between self-efficacy and level of stress was found. It is suggested that further research is conducted, using another research design or examining the influence of other possible predictors on Cognitive Enhancement drug use to better understand the motivation to enhance cognitive abilities by use of drugs. .

Self-Efficacy, Stress, Cognitive Enhancement, Drugs, Students, Mediation, General Self Efficacy Scale, Perceived Stress Scale

Introduction

Cognitive Enhancement & The Use of Drugs

Over the last several years studies show an alarming trend in the field of cognitive enhancement drugs (in the following called CE drugs). The numbers of students using prescription and illicit drugs to enhance their cognitive ability are rising and are as high as never before (e.g. Connor, 2012; Petrounin, 2014; Marsh, 2017). The aim of cognitive enhancement (CE) is generally to boost the cognitive core capacities such as problem-solving abilities, attention, perception and memory processes (Ragan, Bard, & Singh, 2013). There are different ways to enhance those abilities. The most widely used way of enhancement is education (Bostrom & Sandberg, 2009). Education and training does not only help in acquiring specific skills, but in developing a broader and more extensively developed brain structure. This kind of enhancement does also include methods such as mental training, martial arts, yoga or creativity courses (Bostrom & Sandberg, 2009).

But education and mental training are not the only ways in which humans enhance their cognitive abilities. There are several over-the-counter drugs that are highly societal accepted and help stay awake or concentrate. Examples for over-the-counter drugs which are being used for cognitive enhancement are caffeine, in the form of coffee, energy drinks or even caffeine pills, and nicotine (Bostrom & Sandberg, 2009). Those substances are especially helpful against fatigue, enhance alertness and concentration and are part of the daily diet of a big part of the western population. But in the long run they can also have negative consequences such as an increased risk for cancer, strokes and can have negative effects on fertility (Mishra, Chaturvedi, Datta, Sinukumar, Joshi, & Garg, 2015).

While mental training, education and over-the-counter drugs such as caffeine and nicotine fall under more conventional methods of cognitive enhancement, there are also more unconventional ways to enhance cognitive abilities (Bostrom & Sandberg, 2009). Those include taking illicit drugs and prescription drugs. Illicit drugs are substances that are usually taken for the own enjoyment. Substances that fall under that category and which are also used for CE are for example ecstasy, marijuana, amphetamines or cocaine (Franke et al., 2011). Prescription drugs used for CE include methylphenidate (e.g. Ritalin) and Modafinil (Wilens et al., 2008). When used for cognitive enhancement, they are taken by individuals without any medical issue for nonmedical purposes, just to increase their focus and to make it possible for them to concentrate on uninteresting tasks for a longer period of time (Bright, 2008).

The drugs taken for CE all aim at different cognitive core abilities and not on specific skills, but what they all have in common is that they and their usage is ethically disputable (Farah et al., 2009). Safety is one of the biggest issues of these still mainly experimental CE drugs. There are a few to no long-term studies about the effects of drugs like Ritalin or amphetamines (Herman-Stahl, Krebs, Kroutil, & Heller, 2007). Moreover, the doses of those drugs in nonmedical use are not controlled and can thus cause undesirable side-effects. Another critical point is whether the personal freedom of using or not using CE for the individual can be maintained once a majority of workers and academics start using them. Critics claim that CE drugs have the potential to increase the inequality between wealthy and poor by enabling more wealthy individuals to get CE drugs and enhance their cognition while individuals with a more unstable financial background do not get that opportunity (Herman-Stahl et al., 2007).

The use of CE drugs and especially prescription drugs seems to be more prevalent in individuals in cognitively demanding environments such as schools or universities (Herman-Stahl et al., 2007). While a German sample only showed a lifetime prevalence of 1.3 % (Franke et al., 2011) and a Dutch sample documented a prevalence of 1.7% for prescription drugs and one of 1.3% for illicit drugs (Schelle, Olthof, Reintjes, Bundt, Gusman-Vermeer, & van Mil, 2015), most of the studies are conducted in the U.S. and show different prevalences of drug use in college students, ranging from a lifetime prevalence of 5,3% to 55% (DuPont, Coleman, Bucher, & Wilford, 2008; DeSantis, Noar, & Webb, 2009). Those different numbers result from different sampling methods and different methods of calculating the lifetime prevalence. While some studies for example, include every nonmedical use of prescription drugs, others only include the use aiming to heighten the cognitive ability. But one fact all the study results seem to show is, that the prevalence among students is higher than among the general population (Herman-Stahl et al., 2007). The question that arises is, why students are more prevalent to feel the need to use drugs to enhance their cognitive abilities. This study aims to explain this by examining the relationship between students perceived self-efficacy, their reported stress levels and the use of cognitive enhancement drugs. In the following, the particular constructs and the interest in the relationship is explained further.

Self-efficacy

Self-efficacy is a construct described by Bandura as part of the social cognitive theory (Bandura, 1986). Having high self-efficacy entails having the feeling to be able to control and organize the demands of the environment and the own resources to have success (Bandura, 1977). Self-efficacy is described as a central mechanism in self-agency and the selection and construction of the perceived environment (Bandura, 1993). The evaluation of oneself and the own ability to handle situations is important for the functioning of several different processes and influences how good a person actually is in facing the challenges ahead (Sebastian, 2013). It was also found that high levels of self-efficacy play an important role in preventing all different kinds destructive behaviour such as the abuse of drugs (Burleson & Kaminer, 2015).

Low self-efficacy can on the one hand lead to setting oneself low personal goals. Actions are in general first cognitively formulated before executing them and with low self-efficacy the individual lacks the belief in himself to anticipate high goals (O'Leary, 1985). This person would rather anticipate scenarios of failure which then often leads to a self-fulfilling prophecy. Studies have shown that individuals with the same level of knowledge perform better or worse on the same tasks depending on their level of self-efficacy (Bandura, 1993; O'Leary, 1985).

Moreover, self-efficacy has influence on the effort the individuals expend to reach their goals and master their tasks, on how resilient they are to failure and the preservation when facing difficulties (Bandura, 1993). Individuals with higher self-efficacy dare to set themselves higher goals and work on reaching them. Individuals with lower self-efficacy on the other hand will have lower motivation and will invest less in reaching their goals, because they believe it is not worth it, since they will not reach their goal in the end either way (Bandura, 1993).

All in all, it becomes clear, that self-efficacy influences a lot of mental and emotional processes that are of major importance for the psychological wellbeing of the individual (Zulkosky, 2009). When looking at the long-term effects of low self-efficacy it was also found that it can promote depression (Milanovic, Ayukawa, Usyatynsky, Holshausen, & Bowie, 2018). Not feeling able to master threatening situations and to exercise control over one's own worries plays a central role in anxiety arousal and can result in an impaired level of functioning (Bandura, 1993). As mentioned before, the main reasons for individuals to make use of CE drugs was found to be the hope to improve the impaired level of cognitive

functioning (Kumar, Rinwa, Kaur, & Machawal, 2013), thus it can be expected that this impaired functioning might be resulting from low self-efficacy and that low self-efficacy might thus act as a predictor for CE drug use.

Another process that self-efficacy seems to be predicting is the level of stress. Literature found that high levels of distress are more probable to be found in individuals with relatively low self-efficacy (Bandura, 1993).

Stress

Stress is part of every humans' everyday experience and was first defined by Selye in 1936 as "A non-specific response of the body to any demand" (Selye, 1936). This definition is still one of the most widely used ones in research. The definition shows that stress is not only a response to negative events, as often believed, but to every change in demands that occurs (Selye, 1936). Demands that cause stress can be either internal or external and are called *stressors*. Stressors can vary in their form, their intensity and their specific effects, but they all entail the demand for readjusting to a new situation and the related unspecific process they start in the body (Selye, 2013). This leads to the conclusion that stress is nothing generally negative and cannot and should not be avoided.

However, while stress itself is neither something good nor something bad, Selye makes a distinction between two kinds of *stress effects*, namely negative stress effects (*distress*) and positive stress effects (*eustress*) (Selye, 2013). Whether the stress effects are positive or negative depends on whether they are desirable or undesirable. Stress can for example lead to a heightened concentration and a better focus on a task, which would be a positive stress effect and would thus be called eustress. But it can also lead to a feeling of being overwhelmed and fatigue, which would be called distress.

Whether a stressor leads to eustress or distress dependents on three different factors (Selye, 2013). These are; the stressor effect (1), which can be divided into the specific and the unspecific effects and the exogenous (2) and endogenous (3) conditioning. Specific stressor effects are those unique and inseparable to every stressor, while the unspecific effects are those explained before; the demand to adjust to a new situation (Selye, 2013). Exogenous and endogenous conditioning are the external circumstances and influences the individual experiences when dealing with the stressor and the internal circumstances such as personality, age or gender (Selye, 2013). These put the stressor in a context and are defining for how the individual reacts to the stressor and if it will result in eustress or distress (Selye, 2013). This

explains why some people experience a situation as highly stressful while others do not or why an individual finds a situation stressful one day and not stressful at all another day.

Experiencing distress once in a while is not necessarily bad, but if it is ongoing and not coped with in the right way it can lead to a decrease in functioning, well-being and to depression or other psychological and physiological symptoms (e.g. Kaya, Tansey, Meleğlu, & Çakiroğlu, 2015; Elias, Ping, & Abdullah, 2011). Several studies show that in Western societies the general population is more stressed than ever (Stressed in America, 2011). An American survey found that 30% of the teenagers and young adults feel depressed and 31% are overwhelmed because of stress (Thompson, 2017). One possible explanation for the high stress levels in teenagers and young adults are the changing life circumstances which are demanding a lot of adjustments of the individuals. When finishing school, they are leaving for university, start living alone, have new financial obligations or study related worries. In relation to this, studies show that students nowadays often do not possess enough resilience and functioning coping mechanisms to handle these stressors (e.g. Bland, Melton, Welle, & Bigham, 2012; Wagner & Yeong, 2013). This explains the rising numbers of distressed students. One consequence these heightened stress levels seem to result in is the heightened number of students taking CE drugs. Studies found a strong correlation between high levels of stress in students and the probability to make use of drugs to enhance ones' cognitive ability (Liakoni et al., 2015).

Self-efficacy, Stress & Cognitive enhancement drug use

While researching self-efficacy, Bandura also found that there was a clear connection between ones' efficacy in the own coping mechanisms and distress (Bandura, 1993). As explained earlier, a stressor can cause distress in one individual, while the same stressor does not cause negative stress effects in another individual, because they have different ways of conditioning the stressors. Self-efficacy seems to be part of the process of conditioning those stressors. Bandura (1993) found that individuals who do not believe in their own capabilities to control a threat or a difficult situation are experiencing a high anxiety arousal and concentrate on the thought of not being able to cope with the situation and the stressor. During this process they start 'magnifying the severity of possible threats', thus condition the stressors negatively (Bandura, 1993). When then being forced to deal with this situation or threat, their heart rate and blood pressure increases, stress-related hormones are activated and their muscles cramp - they are distressed (Bandura, 1993). When individuals with higher

efficacy in their coping mechanisms are put into the same situation, they experience the same threat or difficult situation, but feel able to handle it, thus condition the stressor more positively and do not feel distressed but stay calm and keep on functioning, which leads to handling the stressor better.

Moreover, the efficacy of being able to control negative thoughts has an influence on the perceived distress. While negative thoughts occur in every individual once in a while, people who believe in their efficacy to let go of these thoughts and turn them off are less likely to experience inner distress than the individuals who do not believe in their efficacy to control these thoughts and feel like they run them over (Bandura, 1993).

It thus seems as if self-efficacy influences perceived stress levels. As mentioned before, studies also show that high stress levels are an indicator for CE drug use (Deline et al., 2014; Liakoni, Schaub, Maier, Glauser, & Liechti, 2015; Schelle et al., 2015; Weyandt et al., 2009). They are not only used to aid the impaired functioning in which distress is often resulting (Kumar, Rinwa, Kaur, & Machawal, 2013), but a study by Deline et al. (2014) also showed that 88.3% of the users of anti-anxiety drugs of a Swiss sample expected a direct decline in stress levels and declared that to be the main reason for taking those CE drugs. Another Swiss study by Liakoni et al. (2015) confirmed the fact that students reporting higher distress were more prone to taking CE drugs.

While the relationships between stress and self-efficacy and between stress and CE drug use are examined several times and seem to be proven, the relationship between self-efficacy and CE drug use stays mainly unexamined. There was only one study found that examined the relationship between pharmacological cognitive enhancement, pharmacological mood enhancement and self-efficacy (Maier, Haug, & Schaub, 2015). This study confirmed a relationship between low self-efficacy in female students and the usage of pharmacological mood enhancement drugs. While this finding is not sufficient to speak of a connection between self-efficacy and CE drug use, there are several studies that show that self-efficacy has an impact on the probability of abusing drugs in general and on the treatment success for substance use disorders, with high self-efficacy leading to success and lower probability to take drugs (Kadden & Litt, 2011; Chavarria, Stevens, Jason, & Ferrari, 2012; Schinke, Schwinn, Hopkins, & Wahlstrom, 2016). Those findings suggest that there is a connection between drug use and self-efficacy. Taken together, those findings in drug research and the

already examined relationship between self-efficacy and stress and stress and CE drug use, leads to concentrating the study at hand on exactly those three constructs.

Current Study

In this study it is tested whether there is a relationship between self-efficacy and the use of cognitive enhancement drugs in which stress acts as a mediator. The aim is to better understand the determinants and reasons behind the use of cognitive enhancement drugs. This will make it easier to deal with the rising numbers of cognitive enhancement drug users, especially in the academic environment, by making it possible to start developing interventions aiming at the roots of the problem. Since there seems to be a connection between the level of self-efficacy and stress, stress and drug use for the enhancement of cognitive ability and self-efficacy and drug use in general, it can also be suspected that there is one between self-efficacy and cognitive enhancement drug use with self-efficacy being the actual predictor of CE drug use with stress having a mediating effect on the relationship.

Thus, the research question this study seeks to answer is:

"Is there a relationship between perceived self-efficacy and cognitive enhancement drug use among students which is mediated by their perceived stress levels?"

The question is therefore divided into different hypotheses:

H_{1a}: *There is a significant negative relationship between the stress levels students experience and their self-efficacy.*

H_{1b}: *There is a significant positive relationship between the reported stress levels of students and their use of CE drugs.*

H_{1c}: *There is a significant negative relationship between self-efficacy and CE drug use.*

H_2: *Stress mediates the relationship between self-efficacy and CE drug use.*

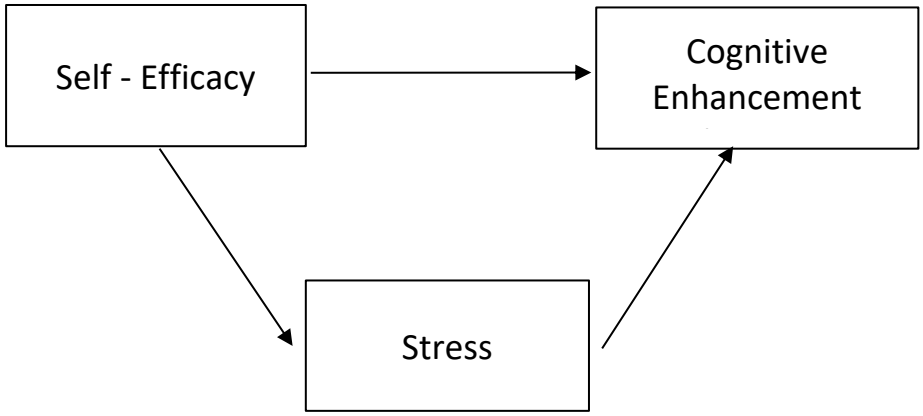

Figure 1. Hypothesized model of the relationship between Self-efficacy, Cognitive Enhancement Drug use and Perceived Level of Stress.

Methods

Design

This quantitative study was conducted in a cross-sectional online survey design. The cross-sectional design is chosen, because it is a relative inexpensive method of collecting a lot of data in a short time (Levin, 2006; Kelley, Clark, Brown, & Sitzia, 2003). Moreover, it is the right design to measure several factors and predictors and to get an impression of a momentary situation (Levin, 2006). The independent variable was self-efficacy. The dependent variable was cognitive enhancement drug use and self-reported level of stress was handled as mediator.

Participants

Participants (n = 175) were recruited through convenience sampling out of the population of students on university level. They were approached via social media channels such as Facebook and via SONA. SONA is a cloud-based online environment that is used by universities to collect subjects for research. Students filling in the survey via SONA received a reward in form of one SONA credit. The inclusion criteria were that (1) the participants had to be eighteen years or older by the time the data was collected, (2) they had to be studying at a university or university of applied science and (3) they were able to properly understand and comprehend the English language. Subjects were excluded of participation due to following exclusion criteria; (1) if they were younger than 18, (2) not studying on university level by the time the research was conducted or (3) not able to understand and comprehend English sufficiently. As shown in Table 1, the subjects were predominantly female and of German

origin. The participants age ranged from 18 to 30 years old (M = 20.8, SD = 2.42). For additional characteristics of the participants see Table 1.

Table 1

Socio-demographic characteristics of participants (n = 175).

Item	Category	Frequency	Percentage
Gender	Female	126	72
	Male	48	27.4
	Other	1	0.6
Age (years)	18 – 21	129	73.7
	23 – 26	37	21.1
	27 – 30	9	5.1
Nationality	German	132	75.4
	Dutch	22	12.6
	Other	21	12
Field of Study	Psychology	130	74.3
	Communication	28	16
	Other	17	9.7
Phase of Study	B1	121	69.1
	B2	18	10.3
	B3	20	11.4
	M1	2	1.1
	Pre – Master	1	0.6
	Other	13	7.4

Measuring Instruments

This study was conducted in collaboration with other researchers, interested in the relationship between other constructs and CE drugs through an online survey which consisted of different scales, screening the different constructs of interest. The instruments named below were used to gather information for the study at hand: A demographics questionnaire, a self-constructed cognitive enhancement drug use questionnaire, the Perceived Stress Scale (PSS) and the General Self-Efficacy Scale (GSE).

Demographics. Self-constructed questions regarding demographics such as the gender, age, nationality, field of study, how many years they were studying already and in which phase of

the study they were by the time the survey was filled in, were used to gather general information on the characteristics of participants (see Table 1).

CE Drug Use. To examine the usage of drugs for cognitive enhancement, self-constructed items were added to the survey. Those items divided the drugs used for CE into over-the-counter drugs (e.g. coffee, energy drinks, caffeine tablets, cigarettes), illicit drugs (e.g. marijuana, ecstasy, cocaine, amphetamine) and prescription drugs (e.g. Ritalin, Modafinil). Prior to the items a short description, including examples, of the three different kinds of drugs was given (See Appendice B). As an example, the following item had to be answered about whether the participant made use of any of the given drugs or similar drugs before in order to enhance cognitive ability (*"Have you ever made use of a substance (one mentioned above or another) to increase your cognitive performance?").* If the participant answered "No" the remaining questions concerning drug use were skipped. If the participants' answer was "Yes" he was asked to answer questions about each of the three categories of substances, e.g. "*What Over-the-counter drugs (like coffee or energy drinks) did you make use of for cognitive enhancement?*". Following that question was one concerning the frequency of usage of this specific substance ("*How often did you make use of Caffeine pills to enhance your cognitive performance in the past 12 months?*"). The answers ranged from 0, 1-3, 4-10 to more than 10. These items were used to learn which drugs the subjects used for CE purposes and the frequency of usage. The scores on the items were taken together to compute the variable 'CE drug use overall' consisting of the subscales 'prescription CE drug use', 'illicit CE drug use' and 'over-the-counter CE drug use'. The variables were computed by taking the reported frequencies and calculate the yearly frequencies of drug use. These scores were translated into the variables by adding the calculated frequencies of the drugs belonging to the same category (illicit, prescription, over-the-counter) together. The reliability was assessed for the whole scale and for the different subcategories. Cronbach's alpha for the whole scale was relatively good with $\alpha = .72$. The scales 'illicit drugs' and 'over-the-counter drugs' showed moderate reliability with $\alpha = .61$ and $\alpha = .64$ respectively. Only the subscale 'prescription drug use' had a weak reliability of $\alpha = .41$.

Stress (PSS). To determine the amount of stress the participants experienced, the Perceived Stress Scale (PSS) in its 10-item version was used. The PSS-10 is a quantitative self-report questionnaire developed by Sheldon Cohen which is used to examine the level of perceived stress and is the most widely used psychological stress scale (Cohen, Kamarck &

Mermelstein, 1983). The test consists of 10 items rated on a 5-point-Likert scale and means to examine to what extent respondents found their lives uncontrollable and overloaded during the last month. The items are formulated widely general (e.g. *"In the last month, how often have you been upset because of something that happened unexpectedly?", "In the last month, how often have you felt that you were on top of things?"*). The possible answers ranged from "Never (0)" to "Very Often (4)". The fact that the items are formulated easy and understandable makes it possible to use the scale with respondents of junior high school level education or higher (Cohen et al., 1983). In order to score the PSS, the positively formulated items (4, 5, 7 & 8) have to be reversed (e.g. 0 = 4; 1 = 3; 2 = 2) and subsequently all item scores are accumulated. So, a high score on the PSS indicates a high level of perceived stress during the last month. All in all, the 10-item version of this questionnaire used in this study was found to have a high internal consistency reliability, factorial validity and hypothesis validity, while test-retest reliability and criterion validity are barely reported in most of the studies the questionnaire came to use in (Lee, 2012). All studies show a Cronbach's Alpha of $\alpha > .70$. A study with a stratified sample of the general population (n = 2,387) by Cohen and Williamson (1988) had a reliability of α = .78 and a study undertaken with undergraduate students had a Cronbach's alpha of α = .89 (Roberti, Harrington, & Storch, 2006). With a Cronbach's alpha of α = .91, the reliability of the PSS for the sample at hand is high as well.

Self-Efficacy (GSE). Self-efficacy was measured by using the General Self-Efficacy Scale (GSE). The GSE is a 10 item self-report questionnaire developed by Schwarzer and Jerusalem in 1995 with the aim to provide a valid and reliable instrument to measure self-efficacy (Schwarzer & Jerusalem, 1995). The items are formulated as statements such as *"I can always manage to solve difficult problems if I try hard enough."* or *"If someone opposes me, I can find the means and ways to get what I want."* which are to be scored on a 4-point Likert scale ranging from "Not at all true (1)" to "Exactly true (4)". The overall score is calculated by summing up all the items, with a higher score indicating higher self-efficacy (Schwarzer & Jerusalem, 1995). With a Cronbach's Alpha around α = .76 - .90 the GSE has a high internal reliability (Schwarzer & Jerusalem, 1995). Matching these findings, the study at hand was found to have a Cronbach's Alpha of α =.88, speaking for a high reliability.

Procedure

The survey was approved by the Ethics Committee of the University of Twente. Data were collected between the 12th of April and 27th of April via an online-survey on the

platform *Qualtrics*. Qualtrics is a software which delivers different tools to help conducting an online survey. During this study it was used to develop the questionnaire and collect the answers. The questionnaire was designed in English to reach a higher number of participants. Participants were collected via social media such as Facebook, but also via SONA systems.

When distributed via Facebook, the Qualtrics link to the study was shared with the Facebook contacts of all researchers. With the link, there came a short text entailing information about the inclusion criteria of the study, the information that the topic was cognitive enhancement drug use, that the data were anonymous and that they were to be used for the bachelor thesis of the researcher. Moreover, it was mentioned that the study was also distributed via SONA systems and that students of the University of Twente had the possibility to receive one SONA point if they participated via SONA. The text was written in German as well as in English to reach as many participants as possible.

When following the link, the participants reached a site containing a few welcoming and thankful words and again information about the topic (e.g. the constructs that were measured) and the procedure of the study. The text also contained the informed consent form (see Appendice A), entailing information that the data were processed anonymously, information about the approximate duration of the study (30-45 min) and that they were allowed to stop their participation at any given point of time without giving a reason. Participants were also provided with the mail addresses of two of the researchers, in case they had any more questions or comments regarding the study. They then had to accept the informed consent form by clicking the button ‘I accept’.

Following the informed consent form the questionnaires had to be filled in. After completing those, gratitude was expressed, and the participants were asked whether they wanted to receive information about the results of the study. If they were interested in getting the results they were asked to fill in their mail-address.

Statistical Analysis

The collected data were processed and analysed by using SPSS v23 (IBM, 2015). First of all, it was checked whether subjects had to be excluded due to not completing the whole questionnaire or due to meeting one or more of the exclusion criteria. The descriptive statistics such as the sum scores, means, standard deviations, Cronbach’s Alphas, Kurtosis and Skewness of all variables were determined. As a cut-of-score for Skewness and Kurtosis -1 and + 1 were set. In order to assess reliability a Cronbach's alpha $\alpha > 0.70$ was handled as acceptable (Gliem & Gliem, 2003).

In order to test hypotheses $H_{1a\text{ - }c}$, three different correlation analyses, using Pearson's coefficients, were carried out. The cut-off value for significance was decided to be $p < 0.05$ and the effect size was to be r = -0.3 - 0/ 0 - 0.3 for no or a small effect, r = -0.5 - -0.3 / 0.3 – 0.5 for a moderate effect and r = -1 - -0.5/ 0.5 – 1 for a strong effect (Rosenthal, 1991). To examine the relationship between the different variables, first of all the correlation between self-efficacy and cognitive enhancement drug use was tested, to see whether the proposed relationship between self-efficacy and cognitive enhancement drug use, exists. Afterwards the correlation between self-efficacy and level of stress was computed, to test whether there is a connection between stress and self-efficacy. As a third step stress was paired with cognitive enhancement drug use.

Next, to test hypothesis H_2, the mediation analysis for the three variables (Stress, Self-Efficacy, Cognitive Enhancement Drug Use) was conducted, using the PROCESS macro (Hayes, 2012). This macro was used to test whether stress has a mediating effect on the proposed relationship between self-efficacy and cognitive enhancement drug use. It can be spoken of a statistical significant mediation if the confidence interval does not contain zero. If the data is normally distributed, the Sobel method and if the data is not normally distributed, bootstrapping will be used to assess the causality of the relationship.

Results

Descriptive Statistics, Reliability, and correlations

Means and standard deviations for all three constructs were computed (see Table 2). To test whether the data were normally distributed, Kurtosis and Skewness were computed. Since the Kurtosis and Skewness values of self-efficacy, level of stress and CE drug use all lie between -1 and +1, it was concluded that the data of those are distributed normally (see Table 2).

To test hypothesis $H_{1a\text{-}c}$, three correlation analyses were carried out using Pearson's correlation coefficients. Table 2 shows that there is a moderate negative, statistically significant relationship between the students' self-efficacy and their perceived stress levels (r = -.43; $p < 0.001$), this confirms H1a.

It was also found that there was no statistically significant relationship between neither CE drug use overall and self-efficacy (r = - *.03; p = 0.7*), nor between their level of stress and CE drug use overall (r = .09; p = .24). Taken together that leads to the decision to discard H_{1b} and H_{1c}.

Table 2

Correlations Among and Descriptive Statistics for Key Study Variables

Variables	*M* (*SD*)	Skewness	Kurtosis	α	Self-Efficacy	Level of Stress
Self - Efficacy	29.85 (*4.76*)	-.12	.13	.88	-	-
Level of Stress	18.66 (*7.0*)	.06	-.40	.91	- .40***	-
CE Use	143.6 (*127.2*)	.80	- .30	.72	- .03	.09

Notes. CE Drug Use = Cognitive Enhancement Drug Use. *** Result is significant at $p < .001$.

Mediation Analysis

In order to test hypothesis H_2, thus whether stress acts as a mediator between self-efficacy and CE drug use, the PROCESS macro was used (Hayes, 2012). As first step of the mediation analysis the regression of self-efficacy on CE drug use overall was carried out. The analysis showed no significant direct effect of self-efficacy on CE drug use overall $b = 0.39$, $t(172) = .17$, $p = .86$. Secondly, the regression of perceived level of stress on CE drug use overall was carried out and also showed no significant relationship, $b = 1.59$, $t(172) = 1.04$, $p = .30$. As a third step, the regression between self- efficacy and stress showed a significant result, $b = - 0.63$, $t(173) = - 6.29$, $p < 0.05$, making self-efficacy a predictor of perceived stress levels. Fourthly, the indirect effect of level of stress as a mediator on the relationship between self-efficacy and CE drug use was tested using 1,000 bootstrap intervals. The analysis showed that there was no indirect effect of level of stress $b = - 1.0$, $SE = 1.18$, 95% *CI* [- 3.62, 1.1]. All results can be found in Table 3.

Table 3

Indirect Effect of Stress on the Relationship between Self-Efficacy and Cognitive Enhancement Drug Use Overall

	Outcome: Level of Stress					Model		
	b	*SE*	*T*	*p*	*r*	R^2	*F*	*p*
Self-Efficacy	- .63	.10	- 6.3	.00*	.43	.19	39.55	.00

	Outcome: CE Drug Use Overall					Model		
	b	*SE*	*T*	*p*	*r*	R^2	*F*	*p*
Level of Stress	1.59	1.53	1.04	.30	.08	.01	.58	.56
Self-Efficacy	.39	2.25	.17	.86				

	Indirect Effect			
	b	*BootSE*	*BootLLCI*	*BootULCI*
Level of Stress	- 1.0	1.18	- 3.62	1.1

Notes. * $p < .05$.

All in all, the results of the mediation analysis lead to the conclusion that self-efficacy does not act as a predictor for CE drug use, nor does level of stress seem to act as a mediator, thus hypothesis H_2 is to be discarded.

Discussion & Conclusion

To gain a deeper understanding of whether there are certain psychological mechanisms and constructs that influence the probability of using drugs for cognitive enhancement, this study aimed to investigate the relationship between self-efficacy, stress and CE drug use. More precisely, it was tested whether the level of stress had a mediating effect on the relation between self-efficacy and CE drug use. On basis of the results of the conducted study, only one of the hypotheses could be confirmed. Moreover, the research question "*Is there a relationship between perceived self-efficacy and cognitive enhancement drug use among students which is mediated by their perceived stress levels?"* can, based on the findings, be answered with no, there was no mediating effect found, but still there were significant results, delivering input and inspiration for further research.

When testing the proposed negative relationship between self-efficacy and level of stress, there was a significant relationship found. The effect self-efficacy has on level of stress

seems to be moderate. Individuals with higher self-efficacy thus seem to be able to condition stressors less negatively and feel less stressed than individuals with lower self-efficacy (Bandura, 1993). This finding confirms the first hypothesis and is line with the literature and stresses the findings and the importance of the social cognitive theory by Bandura (1989, 1993). Several studies found that the ability to condition stressors more positively has an important influence on the perceived levels of distress (Selye, 2013). Additionally, research already proves the effect of interventions aiming on diminishing stress by strengthening self-efficacy (Chang et al., 2004). In the study conducted by Chang et al. (2004), mindfulness-based stress reduction (MBSR) is used as an eight weeks long intervention and effects on stress as well as self-efficacy were examined. Measures showed that post-intervention stress was significantly lower, while self-efficacy was significantly higher (Chang et al., 2004). Several other studies also show the positive effect of mindfulness-based training on self-efficacy and that high self-efficacy seems to be an important predictor of overall wellbeing and does protect the individual for example from depression and anxiety (e.g. Greason & Cashwil, 2009; Soysa & Wilcomb, 2015). These findings suggest that interventions should focus more on strengthening the psyche of individuals in demanding environments and especially on strengthening self-efficacy using interventions to minimize the chance of function-impairing distress.

Contradictory to the literature, the proposed relationship between levels of stress and cognitive enhancement drug use could not be confirmed. That does mean that stress does not seem to predict the usage of CE drugs, while other studies seem to prove this relationship (e.g. Kumar et al., 2013). The study by Kumar et al. (2013) and several other studies showed that stress seems to have a significant influence on CE drug use with students reporting using CE drugs in order to diminish their high stress levels (Deline et al., 2014; Liakoni et al., 2015). The study at hand is thus not in line with those results. This unexpected finding could be explained by the fact that both, the level of stress as well as the CE drug use, among the sample were unexpectedly low. Thus, even if stress influences CE drug use, the sample at hand would not be the right one to examine this relationship, since low levels of stress would also lead to low CE drug use and thus make the connection undetectable. It is also possible that not stress itself influences CE drug use, but that rather the impaired cognitive functioning distress is often resulting in (Kaya et al., 2015), has predictive value for CE drug use. The PPS used in the current study to assess the level of stress does not distinguish between *eustress* and *distress*. It is thus not distinguished between stress leading to negative stress effects and stress leading to positive stress effects (Selye, 2013). If the real predictor of CE

drug use is the impaired cognitive functioning, this would mean that this scale can not lead to usable results in this context, since eustress does rather result in heightened cognitive abilities than in impaired functions (Bandura, 2013) and would thus not lead to CE drug use, which would explain why there is no correlation found between the score on the PSS and CE drug use. This proposed relationship should be examined further by using a different scale to assess negative stress effects.

Moreover, there was no significant relationship found between reported self-efficacy and CE drug use. In line with that, no mediating effect of stress on the relationship between self-efficacy and CE drug use was found. These findings are not in line with the expectations. While the connection between self-efficacy and CE drug use stayed mainly unexamined until now, the connection between drug use in general and self-efficacy (Kadden & Litt, 2011; Chavarria et al., 2012; Schinke et al., 2016) and the connection between stress and self-efficacy (Bandura, 1993) and between stress and CE drug use (Deline et al., 2014; Liakoni et al., 2015), led to expecting a significant relationship between self-efficacy and CE drug use as well. Since, as mentioned before, this relationship stayed mainly unexamined until now, it might just be that there is no clear relationship between self-efficacy and CE drug use and that there are other mechanisms in play when talking about drug use in general compared with CE drugs. While self-efficacy seems to have the effect of helping to stay abstinent (Chavarria et al., 2012) and has protective value in general drug use (Schinke et al., 2016), it is possible that CE drug use is predicted by other psychological mechanisms which have to be examined further. The none existent relationship could on the other hand also be explained by looking at the limitations of the current study and might be further examined in different research designs.

Limitations, Strengths & Practical Implications

When interpreting the results of this study, several limitations should be kept in mind. First of all, the items used for CE drug use were self-constructed and while the overall scale seems to be fairly reliable when looking at the Cronbach's alpha value (.72), the reliability of the different subscales seems to be questionable (.61; .64; .41). Additionally, the 'Over-the-counter drugs' scale had to be computed differently than the other CE drug subscales, because a different timespan was used for this category than for the other two categories. When asking about the usage and the frequency of 'illicit CE drugs' and 'prescription CE drugs', the items were formulated to ask about the usage within the last year. When asking about 'over-the-counter drugs', it was asked about the usage within the last week or the last month. To put the

results of the three categories together and build the scale 'CE drug use overall' the scores on the 'over-the-counter drug use' scale were multiplied with 52 or 12 respectively as it is the number of weeks in a year respectively months in a year, to make the values compatible with the other two subscales. This led to extraordinary high scores on this scale, while the others indicated far smaller frequencies. The multiplying could have led to a relatively high change in frequencies, making the data less precise and less reliable. A suggestion to remove this weakness is to develop a standardized and tested screening instrument for CE drug use. This would make the questionnaire more reliable and would probably lead to better usable results.

Moreover, qualitative research could be conducted to explore the relationship between the three constructs at hand. Semi-structured interviews could possibly deliver more in-depth information about the level of stress and the self-efficacy beliefs of the individual. Since the questionnaires are highly generable and are not specifically addressing the stress and the self-efficacy beliefs related to the study, interviews especially addressing those topics, might lead to different outcomes.

Another weakness of the study at hand is the questionable generalizability and the questionable representativity of the sample at hand. The low levels of stress might for example be explained by the circumstance that the current research was conducted in collaboration with several researchers, studying the influence of different constructs on CE drug use and the questionnaire thus consisted of several scales, making the questionnaire relatively long. This could have led to individuals with a high level of stress not even starting the questionnaire or not finishing it because they felt as if they did not have enough time and felt too stressed by the time they had to spend on filling in the questionnaire. An indication of this could be seen in the fact that 95 of 270 participants did not finish the questionnaire and were thus excluded from participation. This could have resulted in a selective and non-representative sample, excluding those subjects most interesting for this study and leading conclusively to a nonsignificant relationship between CE drug use and stress.

The contradictory finding that there was no relationship between self-efficacy, stress and CE drug use might also be explained by the fact that the study was conducted with mainly Dutch and German university students. Earlier studies showed, and it is also supported by the current study, that the use of drugs for cognitive enhancement purposes still seems to be significantly smaller in the European student population in comparison to the American population (Franke et al., 2011). In America around 5,3 - 55 percent of the student population made use of CE drugs during their studies (DuPont et al., 2008; DeSantis et al., 2009). Research explains this difference with the different laws according drug use and the easy

accessibility of prescription drugs in America (Fischer, Keates, Bühringer, Reimer and Rehm, 2014; Amsterdam & Brink, 2015). This could be an explanation for finding no significant relation between self-efficacy, stress and CE drug use. If the general usage of CE drugs in the Netherlands and in Germany is so much lower, then it is highly possible that the results of the study at hand would change accordingly when conducting it within the American population. In America the relation between stress and CE drug use was already studied several times and is supported by several studies (e.g. Weyandt et al., 2009). It would thus be interesting to examine the relationship between self-efficacy and CE drug use further within the American population. Additionally, the drug use in Enschede might not only be small in comparison to American students, but even in comparison to students in bigger cities such as Amsterdam or Berlin. Studies found that the accessibility of drugs is higher in bigger cities (Warren, Smalley, & Barefoot, 2015) and therefore it might be that the use for CE purposes is significantly higher as well. This would mean, that the results of the current study are only applicable to students in smaller student towns. To dissolve this issue, there are two possible designs for future research. First of all, it would be of interest to conduct a study by putting together a sample solely of known CE drug users by using purposive sampling. This would resolve the issue that the number of students taking CE drugs is too small to deliver reliable and significant findings. When performing the study with known CE drug users the scores on the questionnaires (GSE & PSS) could either be compared to the average score of the general student population or with a control group of students not using any CE drugs. By using this comparative research design, it could be explored whether there is a significant correlation between either self-efficacy and CE drug use or level of stress and CE drug use. Secondly, it might be interesting to consider conducting future research with a more mixed sample, by also actively approaching students in bigger cities or collaborating with researchers from universities in those cities. Due to the fact that all participating researchers studied at the same university and shared the questionnaire with their Facebook contacts, a high percentage of participants is visiting this same university. Working together with other universities would make the sample even more representative and the results more generalizable for the whole student population.

One of the biggest strengths of the study is, that it concentrates on a relationship between three constructs that was not thoroughly examined in research before. Even though the relationship between stress and CE drug use and the relationship between self-efficacy and level of stress was discussed in several studies, the combination of all three was not looked at before, even though the correlation between the single constructs seemed to be

proven. Since the study could not provide any support for the hypothesis that stress, self-efficacy and CE drug use are correlated, it gives the indication to not be too sure about the seemingly proven relation between stress and CE drug use and to examine the relationship between CE drug use and other possible predictors.

Moreover, due to the used research design of an online-based survey and the distribution via social media, it was possible to reach a high number of potential participants. Even though mentioned before, that the sample would be even more representative when partnering with universities in bigger cities, the fact that the survey was composed in English contributed to the fact that participants of different nationalities were able to take part as it is a language internationally used within universities and in research.

In comparison to a pen-and-paper version or a survey solely distributed via SONA, the version used for this study made it possible to reach participants not only from the University of Twente.

Another strength is the high reliability of the Perceived Stress Scale (PSS) and the General Self-efficacy (GSE) scale and the fairly high reliability of the CE drug use scale. It shows that the data can be trusted and that the three constructs were measured in a good and reliable manner. The high reliability also speaks for the proven relation between self-efficacy and stress.

Conclusion

This study explored the relationship between self-efficacy, level of stress and cognitive enhancement drug use in students. While the results did show a relationship between self-efficacy and level of stress, there was no relationship between CE drug use and any of the other constructs proven. The overall number of drugs taken to improve the cognitive enhancement within the sample was relatively small, compared to numbers given in studies conducted in North America. Furthermore, the stress levels were relatively small as well. This paints a - potentially deceiving- positive picture of the Dutch academic system and the demands coming with it. However, even though the amount of CE drugs taken seems to be fairly small, numbers are growing slowly, so eyes should be kept on any changes regarding this trend. Since there is barely any research down about the predictors of CE drug use, this current study is a good beginning to start understanding and focusing on CE drug use. But it is only a beginning and further studies should on the one hand go on exploring the mechanisms motivating students to take drugs to perform better and should on the other hand also find a way to further examine the risks and possibilities coming with CE drug use.

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Appendix

Appendice A: Informed Consent Form

Researchers: Laura Koppmeier, Felix Pawlaczyk, Alexandra Heukamp, Nils Stephan, Nina Günther, Franziska Weist

In agreeing to participate you have the following rights and protections.

Your participation is entirely voluntary and you may stop at any time during the study.

Under no circumstances will your real names or identifying information be included in the reporting of this research.

You may withdraw your data from this research at any point until one week after the submitting the survey.

Nobody, except the six researchers and the research supervisor will have access to this anonymised material in its entirety.

Furthermore, in agreeing to the terms of this consent form, participants should be aware that any anonymised material is solely for use in the current research project.

- I accept (1)
- I do not accept (2)

Appendice B: CE Drug Use Items

First of all, we would like to give you a definition of cognitive enhancement drugs.
Cognitive enhancement drugs are psychoactive drugs that are used to increase one's cognitive performance. This includes improving memory, vigilance, attention and concentration within healthy individuals, who have no prescription for these drugs. Regarding the various substances used for this purpose a distinction can be made between three categories:

1) Over-the-counter drugs like coffee or energy drinks. These substances can be bought at the supermarket without much effort and are therefore very easy to obtain.
2) Prescription drugs initially designed for the treatment of disorders like ADHD or sleep disorders that are being misused for cognitive enhancement. Examples are Methylphenidate (e.g. Ritalin) or Modafinil.

3) Illicit drugs like ecstasy or methamphetamine that are mainly used for recreational purposes but also enhance cognition.

Have you ever made use of a substance (one mentioned above or another) to increase your cognitive performance?

- ○ Yes (1)
- ○ No (2)

Skip To: End of Block If First of all we would like to give you a definition of cognitive enhancement drugs. Cognitive enh... = No

Q93 What Over-the-counter drugs (like coffee or energy drinks. These substances can be bought at the supermarket without much effort and are therefore very easy to obtain) did you make use of for cognitive enhancement?

- ☐ Caffeine pills (1)
- ☐ Caffeinated drinks (e.g. coffee, energy drinks) (2)
- ☐ Cigarettes/Nicotine (3)
- ☐ Alcohol (4)
- ☐ Cannabis/Marijuana (legally bought) (5)
- ☐ Other: (6) _____
- ☐ None (7)

Display This Question:

If What Over-the-counter drugs (like coffee or energy drinks. These substances can be bought at the... = Caffeine pills

Q150 How often did you make use of **Caffeine pills** to enhance your cognitive performance in the past 12 months?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Display This Question:

If What Over-the-counter drugs (like coffee or energy drinks. These substances can be bought at the... = Caffeinated drinks (e.g. coffee, energy drinks)

Q167 How often did you make use of **Caffeinated drinks (e.g. coffee, energy drinks)** to enhance your cognitive performance in the last week?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Display This Question:

If What Over-the-counter drugs (like coffee or energy drinks. These substances can be bought at the... = Cigarettes/Nicotine

Q166 How often did you make use of **Cigarettes/Nicotine** to enhance your cognitive performance in the last week?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Display This Question:

If What Over-the-counter drugs (like coffee or energy drinks. These substances can be bought at the... = Alcohol

Q165 How often did you make use of **Alcohol** to enhance your cognitive performance in the last month?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Display This Question:

If What Over-the-counter drugs (like coffee or energy drinks. These substances can be bought at the... = Cannabis/Marijuana (legally bought)

Q164 How often did you make use of **Cannabis/Marijuana (legally bought)** to enhance your cognitive performance in the last month?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Display This Question:

If What Over-the-counter drugs (like coffee or energy drinks. These substances can be bought at the... = Other:

Q163 How often did you make use of the substance you **referred to in the "others" category** in order to enhance your cognitive performance in the past 12 months?

- ○ 0 (1)
- ○ 1-3 (2)
- ○ 4-10 (3)
- ○ more than 10 (4)

Q92 What Prescription drugs (initially designed for the treatment of disorders like ADHD or sleep disorders that are being misused for cognitive enhancement) did you make use of for cognitive enhancement?

- ☐ Methylphenidate (e.g. Ritalin, Concerta) (1)
- ☐ Modafinil (e.g. Provigil) (2)
- ☐ β-Blocker (e.g. Beloc) (3)
- ☐ Amphetamine (e.g. Adderal, Desoxyn, Dexedrine) (4)
- ☐ Fluoxetine (e.g. Prozac) (5)
- ☐ Piracetam (e.g. Nootropil, Qropi, Myocalm, Dinagen, Synaptine) (6)
- ☐ Cannabis/Marijuana (medical, prescribed by a doctor) (7)
- ☐ Other: (8) _____
- ☐ None (9)

Display This Question:

If What Prescription drugs (initially designed for the treatment of disorders like ADHD or sleep dis... = Methylphenidate (e.g. Ritalin, Concerta)

Q151 How often did you make use of **Methylphenidate (e.g. Ritalin, Concerta)** to enhance your cognitive performance in the past 12 months?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Display This Question:

If What Prescription drugs (initially designed for the treatment of disorders like ADHD or sleep dis... = Modafinil (e.g. Provigil)

Q174 How often did you make use of **Modafinil (e.g. Provigil)** to enhance your cognitive performance in the past 12 months?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Display This Question:

If What Prescription drugs (initially designed for the treatment of disorders like ADHD or sleep dis... = β-Blocker (e.g. Beloc)

Q173 How often did you make use of **β-Blocker (e.g. Beloc)** to enhance your cognitive performance in the past 12 months?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Display This Question:

If What Prescription drugs (initially designed for the treatment of disorders like ADHD or sleep dis... = Amphetamine (e.g. Adderal, Desoxyn, Dexedrine)

Q172 How often did you make use of **Amphetamine (e.g. Adderal, Desoxyn, Dexedrine)** to enhance your cognitive performance in the past 12 months?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Display This Question:

If What Prescription drugs (initially designed for the treatment of disorders like ADHD or sleep dis... = Fluoxetine (e.g. Prozac)

Q171 How often did you make use of **Fluoxetine (e.g. Prozac)** to enhance your cognitive performance in the past 12 months?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Display This Question:

If What Prescription drugs (initially designed for the treatment of disorders like ADHD or sleep dis... = Piracetam (e.g. Nootropil, Qropi, Myocalm, Dinagen, Synaptine)

Q170 How often did you make use of **Piracetam (e.g. Nootropil, Qropi, Myocalm, Dinagen, Synaptine)** to enhance your cognitive performance in the past 12 months?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Display This Question:

If What Prescription drugs (initially designed for the treatment of disorders like ADHD or sleep dis... = Cannabis/Marijuana (medical, prescribed by a doctor)

Q169 How often did you make use of **medical Cannabis/Marijuana** to enhance your cognitive performance in the past 12 months?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Display This Question:

If What Prescription drugs (initially designed for the treatment of disorders like ADHD or sleep dis... = Other:

Q175 How often did you make use of the substance you **referred to in the "others" category** in order to enhance your cognitive performance in the past 12 months?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Q7 What Illicit drugs (like ecstasy or methamphetamine that are mainly used for recreational purposes but also enhance cognition) did you make use of for cognitive enhancement?

- ☐ Amphetamine (e.g. Speed/Pep) (1)
- ☐ Cocaine (2)
- ☐ Methylenedioxymethamphetamine/MDMA (Ecstasy) (3)
- ☐ Cannabis/Marijuana (illicitly bought) (4)
- ☐ Heroine (5)
- ☐ Other: (6) _____
- ☐ None (7)

Display This Question:

If What Illicit drugs (like ecstasy or methamphetamine that are mainly used for recreational purpose... = Amphetamine (e.g. Speed/Pep)

Q152 How often did you make use of **Amphetamine (e.g. Speed/Pep)** to enhance your cognitive performance in the past 12 months?

- ○ 0 (1)
- ○ 1-3 (2)
- ○ 4-10 (3)
- ○ more than 10 (4)

Display This Question:

If What Illicit drugs (like ecstasy or methamphetamine that are mainly used for recreational purpose... = Cocaine

Q180 How often did you make use of **Cocaine** to enhance your cognitive performance in the past 12 months?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Display This Question:

If What Illicit drugs (like ecstasy or methamphetamine that are mainly used for recreational purpose... = Methylenedioxymethamphetamine/MDMA (Ecstasy)

Q179 How often did you make use of **Methylenedioxymethamphetamine/MDMA (Ecstasy)** to enhance your cognitive performance in the past 12 months?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Display This Question:

If What Illicit drugs (like ecstasy or methamphetamine that are mainly used for recreational purpose... = Cannabis/Marijuana (illicitly bought)

Q178 How often did you make use of **illicit Cannabis/Marijuana** to enhance your cognitive performance in the past 12 months?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Display This Question:

If What Illicit drugs (like ecstasy or methamphetamine that are mainly used for recreational purpose... = Heroine

Q177 How often did you make use of **Heroine** to enhance your cognitive performance in the past 12 months?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)

Display This Question:

If What Illicit drugs (like ecstasy or methamphetamine that are mainly used for recreational purpose... = Other:

Q176 How often did you make use of the substance you referred to in the "others" category in order to enhance your cognitive performance in the past 12 months?

- 0 (1)
- 1-3 (2)
- 4-10 (3)
- more than 10 (4)