The Moderating Effect of the Social Norm on the Relationship between Stress and Cognitive-Enhancement Drug Use

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Abstract

This study aims at examining the relationship between stress and cognitive-enhancement (CE) drug use in university students, as well as the moderating effect of the social norm on that relationship. Until today, not many underlying factors and mechanisms are known that drive students to engage in CE-drug use. This study intends to contribute to filling this gap of knowledge. Using a quantitative cross-sectional online survey-based research design (N=270), the participants had to fill in three questionnaires, one about stress (Perceived Stress Scale), one about social norm (Peer Pressure Inventory) and a self-invented scale about their CE-drug use. With the aid of SPSS, descriptive statistics were gathered, and stepwise multiple regression and a moderation analysis were conducted. Based on the results, no significant relations were found between stress and CE-drug use. However, significant correlations had been found between stress and social norm and between social norm and CE-drug use. The study showed that the social norm is an important factor in CE-drug use that has been neglected in existing research. A suggestion for the practice to use this knowledge would be to target the social norm in interventions to educate university students and potentially prevent further CE-drug use.

Keywords: Cognitive-enhancement, drugs, social norm, students, university, moderation

Introduction

In the last few years, American researchers observed a growing trend in the use of cognitive-enhancement (CE) drugs among college students (Bavarian, Flay, Ketcham & Smit, 2013).

Cognitive Enhancement Drugs

Bostrom and Sandberg (2009) defined cognitive enhancement as "The amplification or extension of core capacities of the mind through improvement or augmentation of internal or external information processing systems". Following this definition, CE-drugs are substances that improve one's cognitive abilities with the aim to improve one's performance. Some of those substances are prescription drugs such as methylphenidate (e.g. Ritalin, Concerta, Medikinet), Adderall (mixed amphetamine salts) or modafinil (e.g. Vigil) (Schelle et al., 2015; Franke et al., 2010). Usually, these substances are used to treat people with disorders, such as Alzheimer's. Therefore, they are only available through a medical prescription. For example, Ritalin was developed for treating attention deficit hyperactivity disorder (ADHD) (Husain & Mehta, 2011) and Modafinil is used to treat Narcolepsy and sleep disorders of shift workers (Normann & Berger, 2008). But Modafinil is also known to be abused to prevent fatigue after long working times (Ballon & Feifel, 2006). Other drugs used as cognitive enhancers are illicit drugs such as amphetamines, ecstasy and cocaine (Franke et al., 2010). Legal substances or "over-the-counter"-drugs include caffeine (e.g. energy drinks or caffeine pills), nicotine and alcohol (Eickenhorst, Vitzthum, Klapp, Groneberg, & Mache, 2012; Wolff, Brand, Baumgarten, Lösel, & Ziegler, 2014).

Prevalence of Cognitive-Enhancement Drug Use

In America, the lifetime-prevalence for the use of CE-drugs for students varied from 6.9 % (McCabe, Knight, Teter & Wechsler, 2005) to 8.1 % (Teter, McCabe, Cranford, Boyd & Guthrie, 2006). Another survey among Midwestern universities found that 17% of men and 11% of women reported the use of CE-drugs (Hall, Irwin, Bowman, Frankenberger & Jewett, 2005). In comparison to Europe, American prevalence-rates are rather high. A German study about the use of non-medical prescription stimulants and the illicit use of stimulants for CE purposes with pupils and students found a lifetime-prevalence of almost 3% for students (Franke, Bonertz, Christmann, Huss, Fellgiebel, Hindt & Lieb, 2010). Another study conducted in Germany indicated a prevalence-rate of 2% for students to take CE-drugs. In the Netherlands, the prevalence is even lower. An online study among Dutch university students

found that 1.3% of respondents reported drug-use with the purpose of CE (Schelle, Olthof, Reintjes, Bundt, Gusman-Vermeer & van Mil, 2015).

Stress

Cohen, Kessler and Gordon (1995) defined stress as "A process in which environmental demands tax or exceed the adaptive capacity of an organism, resulting in psychological and biological changes that may place persons at risk for disease". What is perceived as demanding varies per individual. But stressful events or changes in a person's life, whether positive or negative, can create new demands or pressures a person is forced to adapt to (Silverstein & Kritz-Silverstein, 2010). Similar, Lazarus and Folkman (1984) defined stress as a process but separate four different influencing factors: (1) events that cause stress (stressors or stressful life events), (2) cognitive and affective processes that evaluate the event and available coping resources, (3) biological responses and adaptation necessary to cope with the stressor and (4) behavioral and cognitive response to the stressful event (coping). When a person is then confronted with a challenging event, he or she needs to find a way to reduce the stress or to adapt to a new situation by using coping strategies.

Motives for Cognitive-Enhancement Drug Use

Studies suggested the drive of students to improve one's study performance through CE drugs originates from stress caused by high study demands (Mache et al., 2012). When confronted with a subjectively overwhelming amount of workload, students tend to engage more in the use of cognitive-enhancing drugs (Wolff & Brand, 2013). Furthermore, students who take CE drugs experience generally more stress than students who do not (Schelle et al., 2015; Weyandt et al., 2009). What further supports the relationship between stress and the use of CE drugs is that college-enrolled adults are also more likely to use prescription stimulants with the purpose of cognitive enhancement than adults who are not enrolled in college (Herman-Stahl, Krebs, Kroutil, & Heller, 2007). Another study found that universities with highly selective admission criteria have higher prevalence rates of prescription-stimulant abuse which is another indicator of the relationship between study-related stress and drug abuse with the purpose of cognitive enhancement (McCabe et al., 2005). However, environmental factors are not the only ones responsible for eliciting stress: students who report higher subjective levels of performance pressure also show higher rates of using drugs with the purpose of neuroenhancement (Maier, Liechti, Herzig & Schaub, 2013). Generally,

CE drugs are used as a way for students to cope with the stress experienced during their study (Mache et al., 2012; Middendorff, Poskowsky, & Isserstedt, 2012).

Social norm

A factor that might influence the relationship between study-related stress and CE drug use is the social norm. Sherif (1936) described social norms as "The customs, traditions, standards, rules, values, fashions, and all other criteria of conduct which are standardized as a consequence of the contact of individuals". Social norms exert a great impact in people's lives, as they act as a guide or rules on how to behave in social situations. These rules are understood and followed by a groups' members. They are subject to change as they are influenced by the interaction among members. If a member does not follow a social norm or violates it, sanctions will follow (Cialdini & Trost, 1998). The fact that social norms act as rules for behavior make them a crucial factor in decision-making processes. By having the power to influence social norms, a person's social network indirectly plays a big role in decision-making processes as well (Reyna & Farley, 2006).

Various studies support the influence of the social norm on CE-drug use. Bavarian, Flay, Ketcham and Smit (2013) found that the intention and the behavior to engage in the use of CE drugs is strongly associated with positive perceptions by friends and family and positive behavioral norms of friends. Another study conducted to find underlying factors influencing the willingness to use CE drugs showed similar findings (Sattler et al., 2014). If peers strongly disapproved of the use, the willingness of students to engage in use was lower (Sattler et al., 2014). Researchers demonstrate that there is an overall low willingness and acceptability of students in Europe to use CE drugs (Sattler, Forlini, Racine & Sauer, 2013). However, when the researchers asked what would happen if 50% more peers would use it, students tend to be more willing and accepting of the use (Sattler et al., 2013). Similar results that students would be more willing to use enhancers if they knew that others did as well were also shown by other studies (Franke, Bonertz, Christmann, Engeser & Lieb, 2012; Sattler et al., 2014).

This impact of peer prevalence or availability of drugs in one's social network could be a subpart of the social norm. If the peer prevalence-rate is higher, the social norm of using CE-drugs must be more positive and it would be more acceptable for students to engage in CE-drug use. Some studies even state that peers have the greatest influence on students to engage in the use cognitive-enhancing drugs (Mache et al., 2012). For example, most of the

students using CE-drugs have been introduced by a friend, acquaintance or classmate. Others have been introduced by a relative (Mache et al., 2012). Thus, a subpart of the social norm, or a factor through which the norms of a subgroup become visible, is peer pressure. Peer pressure is when your friends encourage you to do certain things or behave in a certain way (Brown & Clasen, 1985). By putting pressure on people to behave in a certain way, the group wants its members to conform to the general social norm. Therefore, peer pressure is also a strong predictor of substance abuse (Santor, Messervey, & Kusumakar, 2000).

Current study

Based on the afore-mentioned literature, the following research question is formulated:

To what extent does the social norm influence the relationship between stress and cognitive-enhancement drug use?

There is a lot of literature that focusses on the prevalence of CE-drug use and what motivates students to take these drugs (Eickenhorst et al., 2012; Rabiner et al., 2009). However, what has been neglected until now is the use of theoretical frameworks to explain this kind of use (Sattler, Mehlkop, Graeff, & Sauer, 2014). Therefore, few variables and behavior patterns are known that influence the decision of university students to engage in CE-drug use. More research is needed to discover the underlying mechanisms and factors that are responsible for why students decide to engage in this specific drug use. This knowledge is important to establish effective prevalence work and to counteract possible future health problems of students, such as drug dependence. This study contributes to fill this gap in literature.

In sum, there is evidence for a relationship between stress and the use of cognitive-enhancement drugs. The literature displays a powerful impact of the social norm on the willingness to use CE-drugs which could have a similar effect on the use of CE-drugs. Although the social norm has impact on the use of CE drugs, using drugs with the purpose of CE in the first place could result from stress. Based on these findings, the following hypotheses are predicted:

H 1: Stress correlates positively with the use of cognitive-enhancing drugs.

H 2a: Stress predicts the use of cognitive-enhancing drugs.

H 2b: Social norm moderates the relationship between stress and cognitive-enhancing drug use.

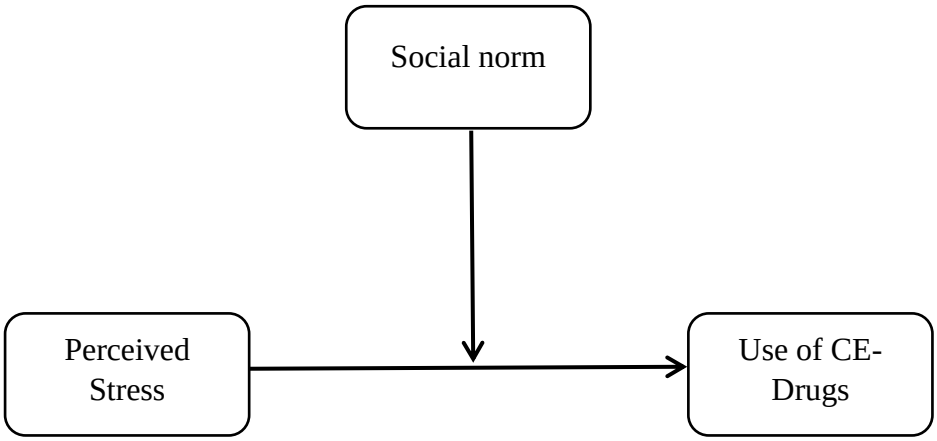

Figure 1. Hypothesized Model for the Relationship between Perceived Stress, Social Norm and the Use of Cognitive-Enhancement Drugs.

Methods

Design

This is a quantitative cross-sectional online survey-based research design which investigates the relations between stress, CE-drug use and social norm. Stress is the independent variable and CE-drug use is the dependent variable. Social norm acts as the moderating variable. A cross-sectional design was used for this study because it holds several benefits. In comparison to other designs it is rather inexpensive and relatively 'easy' to conduct (Levin, 2006). It does not take up huge amounts of time and is applicable to estimate the prevalence of the outcome of interest for a subgroup within a population within a given timeframe (Levin, 2006). To obtain data there was made use of standardized questionnaires and self-invented items.

Participants

A convenience sample (n = 270) was gathered by reaching out to participants by posting a link to the survey on social media such as Facebook and Instagram. To gain participants from the University of Twente, the survey was posted on the platform SONA System which is an online subject pool software. The inclusion-criteria of this study required respondents to be 18 years or older by the time the data was collected, and they had to be university students. Moreover, the participants were required to properly understand and comprehend the English language. Consequently, the exclusion-criteria of this study involved participants being younger than 18 years old and not enrolled at a university.

After screening the data, 95 participants were removed from the analysis because they did not complete the questionnaire and 175 participants were left to include in further analysis. The sample was predominantly female and of German nationality. The participants' ages ranged from 18 to 30 (*M*= 20.79, *SD*= 2.42). For further detail, table 1 gives a full overview of the demographical characteristics of the 175 included participants.

Table 1

General Demographical Characteristics of the Sample (N= 175)

Item	**Category**	**Frequency**	**%**
Sex	Male	48	27.4
	Female	126	72
	Other	1	0.6
Age (years)	18 – 21	129	71.7
	22 – 25	35	20
	26 – 30	11	6.3
Nationality	German	132	75.4
	Dutch	22	12.6
	Other	21	12
Study field	Psychology	131	74.9
	Communication Science	29	16.6
	Economics	2	1.1
	Medical Technology	2	1.1
	Social Work	2	1.1
	Agriculture	1	0.6
	Creative Media and Game Technology	1	0.6
	Creative Technology	1	0.6
	Environment and Resource Management	1	0.6
	German Studies and Biology	1	0.6
	Mathematics	1	0.6
	Medicine	1	0.6

Measuring instruments

This study was conducted as an online survey via the platform *Qualtrics*. This platform is a software for collecting and analyzing data. In this study different researchers were involved. Therefore, several constructs have been measured within the survey. The relevant constructs for this study were the use of CE-drugs, perceived stress and social norm.

Demographics. There were also seven items about demographic variables such as age, gender, study field, nationality and about the study-year the respondent is now following.

Cognitive-enhancement drug use. To measure the use of cognitive enhancement drugs, 24 self-developed items had been used (see Appendix). The first item gave a definition of cognitive-enhancement (CE) drugs and the three categories they fall into and asked if the participant ever made use of a drug with the purpose of CE. Per category (over-the-counter-drugs, prescription drugs, illicit drugs), the participant was given a list of drugs and had to indicate which drugs he specifically made use of and the frequency of the use of each drug in the past 12 months, the past month and past week. These items were such as *"How often did you make use of caffeine pills to enhance your cognitive performance in the last 12 months?"* with answer possibilities ranging from 0, 1-3, 4-10 to more than 10. The higher the scores on this scale, the more frequent is the use of CE-Drugs. The overall reliability of the scales could be rated as good with a Cronbach's Alpha of .72. Assessing the reliability for each subscale, the "over-the-counter"-drugs scale and the scale about "illicit drugs" showed a moderate internal consistency (α= .64; α= .61). However, the subscale for "prescription-drugs" showed an α= .41, which reflects low reliability.

Stress. To determine the amount of stress the participants experienced, the Perceived Stress Scale (PSS-10) was used. The PSS is a quantitative self-report questionnaire used to examine the level of perceived stress (Cohen, Kamarck & Mermelstein, 1983). It was developed by Sheldon Cohen. The test consists of 10 items rated on a five-point-Likert scale ranging from 0 (*Never*) to 4 (*Very often*). Items such as "*In the last month, how often have you felt that you were unable to control the important things in your life?"* are meant to examine to what extent respondents find their lives uncontrollable and overloaded during the last month. Scores are obtained by reversing the responses to the positively stated items (4, 5, 7, & 8). The sum of all scores makes up the overall score. The higher the overall score, the more stress the participant experiences. The PSS can be used for respondents with junior high school level education or higher (Cohen, Kamarck & Mermelstein, 1983). The reliability of the PSS in this study was found to be good (α = .91). This was supported by other literature in which the psychometric properties of the PPS-10 were rated as acceptable (Lee, 2012). Lee (2012) also demonstrated good internal consistency of the PSS-10 with a Cronbach's Alpha higher than .70.

Social Norm. To gain insight in how students might be influenced through the social norm the Peer Pressure Inventory was used. This standardized questionnaire was used because until now there is no standardized questionnaire present to measure the general social

norm of, and its influence on, a subgroup. Norms are very broad concepts and differ per topic and per subgroup. Through measuring the peer pressure, insight will be gained if participants are affected by the social norms their peers hold. That means that the higher the peer pressure experienced, the more affected the individual will be by it.

The Peer Pressure Inventory was developed by B. Bradford Brown and Donna Rae Clasen. It is a quantitative self-report questionnaire which consists of 53 items divided into five subscales (Brown & Clasen, 1985). The items are rated on a 4-point Likert Scale ranging from 0 (*No pressure*) to 3 (*Lot pressure*) whose sum make up the overall score. The higher the overall score, the higher is the peer pressure the participants feel. The items consist of two opposite statements where the participant has to indicate how much pressure he/she feels during certain activities (e.g. *"How strong is the pressure from your friends to …study hard, do your homework, etc.?/ … NOT study or do your homework?"*) (Brown & Clasen, 1985). The overall reliability of the Peer Pressure Inventory is α= .93 which demonstrates a good reliability. The first subscale is Peer Conformity (nine items, α= .73) with items such as "*How strong is the pressure from your friends to …take different classes than your friends take/… take the same classes that your friends take?"*. The second subscale is Family Involvement (seven items, α= .69) with items such as *"How strong is the pressure from your friends to … ignore what your parents tell you to do/…do what your parents tell you to do?"*. The third subscale is Peer Involvement (ten items, α= .74) with items such as *"How strong is the pressure from your friends to … be social, do things with other people/… NOT be social, do things by yourself?"*. The forth subscale is School Involvement (eight items, α= .68) with items such as *"How strong is the pressure from your friends to …take accelerated (advanced level) classes/…NOT take accelerated (advanced level) classes?"*. The fifth subscale is Misconduct (ten items, α= .73). There are also nine items such as *"How strong is the pressure from your friends to … excel, be really good at something (sports, grades, slamming beers, whatever)/ … NOT be better than any of your friends at something?"* that do not belong to one of the subscales (α= .70) (Brown & Clasen, 1985).

Procedure

The survey was created via the online platform *Qualtrics*. The data-collection started on the 12th of April 2018 and ended on the 27th of April 2018. Beforehand, the study was approved by the Ethical Committee of the faculty of Behavioural, Management and Social Sciences (BMS) at the University of Twente. Participants of the survey were reached through social media, such as Facebook and Instagram, by posting a link to the survey with a short explanation of the aim and topic of the study. Besides, the link was made public to other

students at the University of Twente on the platform SONA Systems. Through this platform, students will be granted credits for their participation in studies.

By clicking on the link, the participants were given information about the study's topic, its aim, estimated duration of the study (30 - 40 min), what variables will be measured and an email-address of one of the researchers for questions or comments prior to the study. Following this introduction, the informed consent was presented highlighting the confidentiality and the anonymity of the participant and the right to withdraw at any moment. By consenting to these terms, the participants next had to fill out the questionnaire. At last, the participants were asked if they were interested in receiving the results of the study and if so, given the opportunity to indicate their email-address. The survey was completed with a thank you note and email-addresses from the researchers for any additional remarks or questions.

Statistical analysis

For all statistical analyses the software SPSS v25 was used (IBM, 2017). The software PROCESS macro for SPSS (Hayes, 2018) was used for linear regression models to determine whether social norm acts as a moderator in the relationship between stress and CE-drug use. First, descriptive statistics were assessed for each variable (CE-drug use, Stress, & Social Norm), involving the mean-scores and standard deviations. Skewness and Kurtosis were also calculated to investigate the normality of the data. The cut-off scores were set as +1 and -1 for Skewness and for Kurtosis. After that Cronbach's Alpha coefficients were derived for each scale to check for reliability. A value of $\alpha > .70$ was considered acceptable (Tavakol & Dennick, 2011). Furthermore, Pearson correlation coefficients of the variables (Stress, CE-drug use, Social Norm) were assessed to investigate their relationship. The effect sizes were set at .30 (medium effect) and .50 (large effect) (Cohen, 1992). Statistical significance was set at $p < .05$. After that multiple regressions were used to test for two models. Model 1 was used to test whether stress predicts the use of CE-drugs and in model 2 an interaction-term was created of stress and social norm, looking at the effect it had on CE-drug use. Prior to the analyses, stress and social norm were mean-centered to compensate for potential high multicollinearity with the interaction term (stress x social norm). Two items from the Peer Pressure Inventory were excluded from analyses, item 23 (*"How strong is the pressure from your friends to …finish high school? / …drop out of school?*) and item 34 (*"How strong is the pressure from your friends to… get beer or liquor before you're 18? / … NOT get beer or liquor until you're 18?"*). These items were excluded because they did not match with the

topics described in the inclusion-/exclusion-criteria for participation that were set beforehand. This study focused on university-students that are older than 18 years. Therefore, items 23 and 34 are not suitable for this target group.

Results

First, descriptive statistics of the variables will be presented. After that, the Pearson correlations of the various variables, as well as the regression analyses and the moderation analysis will be shown.

Descriptive statistics, reliability and correlations

First, descriptive statistics were generated for each variable. Then Cronbach's Alpha was assessed for the various scales being used. The reliability of all scales was found to be acceptable (Table 2). To estimate the distribution of the data, Skewness and Kurtosis were used. Concerning the variable Stress and CE-Drug Use, the data was normally distributed (Table 2). Using Skewness and Kurtosis for social norm, it can be seen that the data is positively skewed and has a more peaked distribution.

Following the descriptive analyses, Pearson correlations among the variables were established to test whether stress positively correlates with CE-Drug Use (Table 2). This correlation was found to be weak and not significant ($r = .08$, $p > .05$). That indicates that there is no significant association between stress and CE-drug use found in this study and H-1 will be rejected. However, there was found to be a significant correlation between stress and social norm ($r = .25$, $p < .05$), as well as between social norm and CE-drug use ($r = .29$, $p < .05$). That shows that there is a positive association between these variables.

Table 2

Means, Standard Deviations, Alphas and Correlations for Each Scale

Scale	*M*	*SD*	*α*	*Skewness*	*Kurtosis*	*Stress*	*CE-Drug Use*	*Social Norm*
Stress	1.87	.70	.91	.06	-.40	1	-	-
CE-Drug Use	144	127	.72	.76	-.28	.08	1	-

Social Norm	.33	.28	.93	1.78	4.40	.25*	.29*	1

Note. *p < 0,05.

Regression analyses and moderation analysis

To test the second hypothesis, whether stress is a predictor of CE-drug use (H-2a), a regression analysis was used. This analysis showed that stress is no significant predictor of CE-drug use (Table 3). Consequently, H-2a can be rejected.

Table 3

Regression analysis of Stress and CE-Drug Use

	Unstandardized Coeffecients		Standardized Coefficients					
Model	*β*	*Std. Error*	*Beta*	*t*	*p*	*F*	*R*	R^2
(Constant)	116.166	27.42		4.24	.000	1.15	.08	.01
Stress	14.73	13.77	.08	1.07	.29			

Note. Dependent variable: CE-Drug Use

To check whether the social norm had a moderating effect on the relationship between stress and CE-drug use (H-2b), a pathway model was used with stepwise multiple regressions. The first model included stress and social norm as independent variables and CE-drug use as dependent variable. The analysis revealed that stress and social norm accounted for a significant amount of variance (R^2 = .08, F(2, 173) = 7.75, p < .001).

For the second model, an interaction term of stress and social norm was created and added to the regression (Stress x Social Norm). This model also accounted for a significant amount of variance (R^2 = .10, F(3, 173) = 6.41, p < .000). This indicated that there is a potential significant moderation occurring. However, by examining the R^2-change, it shows that the second model does not significantly explain more variance than the first model (R^2-change = .02, p > .05). That indicates that there is no moderation effect occurring. Conducting the moderation analysis with the aid of PROCESS further supports this notion by showing that the interaction-term is not significant (Table 4). Therefore, H-2b can be rejected.

Table 4

Moderation analysis of Stress, Peer Pressure and CE-Drug Use

Model	β	Std. Error	t	p	F	R	R^2
(Constant)	138.80	9.49	14.48	.00*	6.41	.32	.10
Stress	3.29	13.72	0.24	.81			
Social Norm	117.17	35.50	3.30	.00*			
Stress*Social Norm	99.85	53.33	1.87	.63			

Note. *$p < 0,05$

Discussion

This study aimed to examine the relationship between stress, CE-drug use and social norm. It was predicted that there is a positive association between stress and CE-drug use, as well as that stress predicts the use of CE-drugs. The social norm was expected to have a moderating effect on the relationship between stress and CE-drug use.

There was no relationship found between stress and CE-drug use. That means that stressed students do not necessarily use CE-drugs more often than students who are not stressed. This finding is not supported by the literature. Dutch researchers, as well as American researchers, found that compared to students that are not engaging in CE-drug use, students that do engage in CE-drug use generally experience more stress (Schelle et al., 2015; Weyandt et al., 2009).

Concerning the second hypothesis, no relations had been found. That means that stress does not predict the use of CE-drugs which is also not in line with current literature. Several studies found evidence that stress initiates the use of CE-drugs: one study showed that when students are confronted with a subjectively overwhelming amount of workload, they tend to increase their use of CE-drugs (Wolff & Brand, 2013). In several studies, stress was one of the most recurring motives for students take CE-drugs (Mache et al., 2012; Wolff & Brand, 2013). In other studies, CE-drug use was explicitly mentioned as a means to cope with stress (Mache et al., 2012; Middendorff, Poskowsky, & Isserstedt, 2012).

There are different possible explanations as to why the results turned out to be not significant for the first hypothesis and the first part of the second hypothesis. One if them is that this sample did not experience high amounts of stress as it was predicted based on the

literature. That could mean that they do not feel the need to engage in CE-drug use due to this lack of stress. This is supported by the fact that the use of CE-drugs is also low in this sample.

What could possibly account for the low stress levels in this sample, is the fact that the participants did not have a stressful period at the time when the data was collected. A qualitative study found that students do not engage in CE-drug use daily but in periods when there is an increased level of workload, e.g. exam-periods (DeSantis, Webb, & Noar, 2008). The period of data collection was set around the time when the Bachelor-students of the University of Twente have re-sits. But since not everybody has to redo exams, it could be that the majority of participants did not have to study for any exams at the time of the data collection and therefore did not feel the need to engage in CE-drug use. Another factor that might have contributed to the low stress levels is that the students had less classes than usual during the month of the data collection. In April, there were two Dutch holidays (Easter on 1st and 2nd of April & King's Day on 27th of April) where the students did not have any classes to attend to. Consequently, they had more time to release tension which might have ultimately led to lower stress levels.

A possible explanation for the low prevalence of CE-drugs is that in the Netherlands and in Germany, there are different attitudes of doctors and harsher policies concerning the prescription of CE-drugs, such as Methylphenidate, compared to America (Fischer, Keates, Bühringer, Reimer, & Rehm, 2014). Here, these drugs are foremost prescribed by doctors as treatment for disorders and illnesses. Therefore, it is more difficult to obtain CE-drugs in the Netherlands or Germany because if someone does not have a prescription, they would have to obtain them illegally. Illegally obtaining drugs is considered a crime making it a challenge for people to acquire them. The same applies to other illegal drugs, such as amphetamines or ecstasy. In America, there are several factors that make it easier to gain access to this kind of drugs. Doctors generally employ a more relaxed attitude towards the prescription of CE-drugs (Fischer, Keates, Bühringer, Reimer, & Rehm, 2014). The documentary 'Take your pills' gives insight into how easy it is to obtain a prescription from a doctor for CE-drugs in America even though one is not suffering from an illness (Klayman, Osborn, Hepburn, Clements, & Goldman, 2018). Furthermore, America employs much less restricted policies surrounding the dispensation of prescription drugs (Fischer, Keates, Bühringer, Reimer, & Rehm, 2014). This might be a possible explanation why the use of CE-drugs is rather low in this sample. The low prevalence rates are also supported by current research in the Netherlands (Schelle et al., 2015).

Another possible explanation for the low rates of CE-drug use is the geographical location. Most of the participants are students at the University of Twente, situated in Enschede, because they filled the study in via the platform SONA Systems which is only accessible to students of the University of Twente. Enschede is a smaller city (Population in 2015: 158553) located in a more rural area. This might have contributed to low prevalence rates because illicit and prescription drugs are harder to access in rural areas than in more urban areas (Warren, Smalley, & Barefoot, 2015).

It was expected that the social norm moderates the relationship of stress and CE-drug use. Meaning that when there was high peer pressure, the relationship between stress and CE-drug use would be stronger. However, the results showed that there was no moderation effect occurring. Until now, there is no literature available that examined the relationship between stress, CE-drug use and the social norm in this way. Therefore, this hypothesis cannot be compared to existing research. However, when comparing it to the literature that connects stress and CE-drug use and social norm and CE-drug use, it can be concluded that the findings are not in line with existing research. Since, based on the literature, stress initiates the use of CE-drugs (Wolff & Brand, 2013) and a positive social norm has a positive influence on the willingness to engage in CE-drug use (Bavarian, Flay, Ketcham and Smit, 2013), it would have been likely for a moderation to occur.

Yet, what has been found is a positive significant association between social norm and stress and social norm and CE-drug use. That conveys that if the participants experience strong peer pressure (social norm), they experience higher stress levels and they also engage more frequently in CE-drug use. This finding suggests that in this sample social norm could potentially be more important in the prediction of CE-drug use than stress because there is no relationship found between stress and CE-drug use. This is also supported by a study which states that the opinions of others towards CE-drug use is a strong predictor of actually engaging in the use (Bavarian, Flay, Ketcham, & Smit, 2013). Another study argues that friends and peers have the greatest influence on an individual to engage in CE-drug use (Mache et al., 2012) which further supports social norm as a strong influencer on CE-drug use.

Limitations, Strengths and Recommendations

In interpreting the results of this study, the following limitations should be taken into account. One limitation of the study was the questionnaire that was used to assess Peer

Pressure/Social Norm. By taking a detailed look into the questionnaire, it becomes clear that the Peer Pressure Inventory was primarily created to assess the Peer Pressure that is felt by teenagers that are still in High School. Many items covered topics that are more relevant for High School attendants that are underage and still living with their parents, e.g. family involvement. Two items (item 23 & 34) therefore had to be removed from the analyses because they did not match the inclusion-criteria of being at least 18 years old and studying at a university. Therefore, it could have been difficult for the participants to answer the questions and falsify the data. Still, until today the Peer Pressure Inventory is the most suitable instrument available to measure peer pressure. A recommendation for future research would be to develop a questionnaire that is explicitly suitable to assess the peer pressure felt by university students.

A second limitation of the study was the convenience sampling which was used due to lack of time. The problem that arises is that the sample is not representative because it is not normally distributed across the categories age, gender, study field and nationality. This might have led to insignificant results. For example, according to McCabe, Knight, Teter and Wechsler (2005) men are more likely to engage in CE-Drug Use than women. But in this study, men were underrepresented with a percentage of only 27.4% of the participants being male. The same occurred with the variable study field: 74.9% of participants study psychology and 16.5% study communication science. But one study found that there are differences in the use of CE-drugs in terms of study field. Middendorff, Poskowsky, and Isserstedt (2012) showed that students in medicine or healthcare-related studies, in law or economics, sports and veterinary medicine have an increased use of CE-drugs compared to other studies, such as social sciences including Psychology and Communication science. A suggestion for future research would therefore be to change the sampling method to establish a normal distribution. The future survey should be distributed at more universities in the Netherlands and Germany to generate a more representative sample across different categories. It would also be interesting to target universities with lots of diverse study fields to capture the differences of CE-drug use in terms of study field.

A limitation of the study which made it difficult to interpret the results regarding the causality of the variables was the design chosen. A cross-sectional research design was employed because it gives the opportunity to collect feasible results within a limited amount of time that was given here. But cross-sectional research designs make it impossible to draw any conclusions about the causality of variables (Levin, 2006). A recommendation for future

research would be to select a different research design where researchers are able to determine the causality of variables. This would be extremely valuable in further exploration of the relationship between social norm and CE-drug use. Since the results of the study gave rise to the possibility of the social norm being an independent variable or a predictor of CE-drug use, it would be interesting to see whether this idea is supported by evidence through an experimental design. For example, Sattler et al. (2013) conducted a research in which they used descriptions, so-called "vignettes", about different substances that can be used for CE and their characteristics, such as the probability and severity of side-effects, relative performance and the peer prevalence. The participants had to imagine the scenario and were then asked if they were willing to use this substance (Sattler et al., 2103). This study has been conducted at one University in Canada and one in Germany. A similar study to that could be used at Dutch universities to gain more detailed insight into the relationship between social norm and CE-drug use and its causality. Another possible research design would be conducting a qualitative study among university students that already engage in CE-drug use. The advantage of this design is that more in depth information can be collected by researchers. Thereby giving rise to other factors that might be influencing the use of CE-drugs that researchers do not know about yet.

One strength of the study was that the self-invented CE-drug use scale proved as a reliable and good measure. But the most important strength of this study is that it contributes to filling the gap of knowledge surrounding the underlying factors influencing CE-drug use. There are no studies until now that directly examined the relationship between all three variables: stress, CE-drug use and social norm. Moreover, this study discovered that stress is not the only important factor responsible for the use of CE-drugs which is often portrayed in the literature. There is a social component involved that has a strong impact on engaging in CE-drug use, which has not been intensely researched until now. This study helped to create more awareness about this component.

Conclusion

Recapitulating, this study offers valuable insights into the domain of CE-drug use performed by university students. It gives rise to an important factor that exerts influence on the use of CE-drugs, namely the social norm. With this knowledge, not only can further research be established in this area, but the practice can benefit from it by targeting the social

norm in interventions. This could be especially valuable in educating university students about CE-drugs and possibly preventing further CE-drug use.

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Appendix

CE-Drug Use Scale

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.

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

○ Yes ○ No

2) 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?

- o Caffeine pills
- o Caffeinated drinks (e.g. coffee, energy drinks)
- o Cigarettes/Nicotine
- o Alcohol
- o Cannabis/Marijuana (legally brought)
- o Other:
- o None

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

○ 0 ○ 1-3 ○ 4-10 ○ more than 10

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

○ 0 ○ 1-3 ○ 4-10 ○ more than 10

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

○ 0 ○ 1-3 ○ 4-10 ○ more than 10

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

○ 0 ○ 1-3 ○ 4-10 ○ more than 10

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

○ 0 ○ 1-3 ○ 4-10 ○ more than 10

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

9) 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 ○ 1-3 ○ 4-10 ○ more than 10

10) 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)
- Modafinil (e.g. Provigil)
- β-Blocker (e.g. Beloc)
- Amphetamine (e.g. Adderal, Desoxyn, Dexedrine)
- Fluoxetine (e.g. Prozac)
- Piracetam (e.g. Nootropil, Qropi, Myocalm, Dinagen, Synaptine)
- Other:
- None

11) How often did you make use of **Methylphenidate (e.g. Ritalin, Concerta)** to enhance your cognitive performance in the past 12 months?
○ 0 ○ 1-3 ○ 4-10 ○ more than 10

12) How often did you make use of **Modafinil (e.g. Provigil)** to enhance your cognitive performance in the past 12 months?
○ 0 ○ 1-3 ○ 4-10 ○ more than 10

13) How often did you make use of **β-Blocker (e.g. Beloc)** to enhance your cognitive performance in the past 12 months?
○ 0 ○ 1-3 ○ 4-10 ○ more than 10

14) How often did you make use of **Amphetamine (e.g. Adderal, Desoxyn, Dexedrine)** to enhance your cognitive performance in the past 12 months?
○ 0 ○ 1-3 ○ 4-10 ○ more than 10

15) How often did you make use of **Fluoxetine (e.g. Prozac)** to enhance your cognitive performance in the past 12 months?
○ 0 ○ 1-3 ○ 4-10 ○ more than 10

16) 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 ○ 1-3 ○ 4-10 ○ more than 10

17) How often did you make use of **medical Cannabis/Marijuana** to enhance your cognitive performance in the past 12 months?
○ 0 ○ 1-3 ○ 4-10 ○ more than 10

18) 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 ○ 1-3 ○ 4-10 ○ more than 10

19) 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
- Cocaine
- Methylenedioxymethamphetamine/MDMA (Ecstasy)
- Cannabis/Marijuana (illicitly brought)
- Heroine

- Other:
- None

20) How often did you make use of **Amphetamine (e.g. Speed/Pep)** to enhance your cognitive performance in the past 12 months?
○ 0 ○ 1-3 ○ 4-10 ○ more than 10

21) How often did you make use of **Cocaine** to enhance your cognitive performance in the past 12 months?
○ 0 ○ 1-3 ○ 4-10 ○ more than 10

22) How often did you make use of **Methylenedioxymethamphetamine/MDMA (Ecstasy)** to enhance your cognitive performance in the past 12 months?
○ 0 ○ 1-3 ○ 4-10 ○ more than 10

23) How often did you make use of **illicit Cannabis/Marijuana** to enhance your cognitive performance in the past 12 months?
○ 0 ○ 1-3 ○ 4-10 ○ more than 10

24) How often did you make use of **Heroine** to enhance your cognitive performance in the past 12 months?
○ 0 ○ 1-3 ○ 4-10 ○ more than 10

25) 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 ○ 1-3 ○ 4-10 ○ more than 10