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Stress and Stress Mindsets in Relation to Substance Use Among University Students: A Moderation Analysis

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Faculty of Behavioral Management
and Social Sciences (BMS)
Department of Psychology

by
Paula Anna Marie Friedrichs (s1860445)

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Abstract

Nowadays, stress is an integral part of everyday life. Literature suggests that the prevalence of stress is remarkably high among students. Students are not only prone to stress, but were also found to have an increased risk to engage in substance use. Previous research already suggested a relationship between stress and substance use. Nevertheless, there is a lack of research on this topic, especially with the target group students. This research constitutes the first large-scale research to gather descriptive data regarding stress, stress mindsets and substance use among the students of the University of Twente. Moreover, this research investigated whether a relationship between stress and substance use exists and if the stress mindset, the individual evaluation of stress, moderates this relationship. Data of 1328 students of the University of Twente have been gathered by means of a cross sectional online survey. The data was analyzed by means of SPSS Statistics v24. Some interesting statistics regarding stress, stress mindset and substance use among students of the University of Twente, have been revealed: The students' perceived stress was found to be on a moderate level (M = 27.3, SD = 8.57). However, 43,98% of the student sample fell in the category of severe stress. This finding was crucial, since it calls for action in regard to stress reduction. According to the SMM, the evaluation of stress was found to be rather negative among the students (M = 12.7, SD = 5.03). Moreover, the prevalence of severe substance consumption was relatively low regarding all the substances. In order to investigate the relationship between stress and substance use, a moderation analysis has been conducted for four substance categories: Tobacco, Alcohol, Cannabis, Other substances. Results indicated that stress, assessed by measures of the PSS-14, did not have an effect on substance use. Moreover, the stress mindset, assessed with the SMM, did not manifest itself as having a moderating function in regard to stress and substance use. However, some new insights of what is going on with the students of the University of Twente was gained. The results of this research will be used to design an UT-action plan towards student wellbeing. Nevertheless, there is still a need for further research on the topic.

Keywords: stress, stress mindset, stress beliefs, cross sectional survey, substance use, cannabis, alcohol, tobacco, university students, moderation analysis, regression

Introduction

These days, stress, experienced in several situations, is an integral part of everyday life for many people. A study in 2015, found that more than half of a working population reported that they regularly perceive moderate to high levels of stress in their everyday life. Within the last few years, stress has become a large-scale research concept. This is not only due to the high prevalence of stress, but also because of the significant link between stress and several health outcomes, as well as, illnesses, like inter alia cancer (Cohen, Janicki-Deverts, & Miller, 2007). Similarly, it was found that stress was positively correlated with physical symptoms and complaints like inter alia pain and inflammation (Hannibal & Bishop, 2014). The World Health Organization alerts the people about the damaging effects of stress, like for example heart disease (WHO, 2019). Since heart disease is the leading cause of death in the world, the direct link between stress and cardiovascular disease, should be taken seriously (Quick & Henderson, 2016). Moreover, it has been found that reported stress was frequently followed by symptoms of depression (Wiegner, Hange, Björkelund, & Ahlborg, 2015). This makes clear that stress is not only a common social phenomenon, but might also pose several risks, which should be considered carefully. Hence, there is a need for further investigations on stress. A study found that 77.6% of an undergraduate student sample, fell in moderate or serious stress categories (Abouserie, 1994). This alarmingly high number suggests that especially students are prone to stress. A study in 2010, found that 'Psychological distress was associated with disability and lower academic achievement' among university students (Stallman, 2010). Supplementary, it was found that distress in students was significantly correlated with increased thoughts of dropping out (Dyrbye et al., 2011). Furthermore, the mental health condition was found to be worse for students who reported more stress than their peers. For instance, 86.3% of the stressed student population sample demonstrated symptoms of anxiety and 79.3% of the sample reported depressive symptoms (Saleh, Camart, & Romo, 2017).

There has been a lot of discussion about a uniform definition of stress. Nowadays, there are several definitions of stress. A common definition of stress is 'physical, mental, or emotional strain or tension' (The American Institute of Stress, 2019). Another well-established definition of stress is 'Stress refers to the problems or strains that people encounter throughout life'. Both

definitions emphasize the negative aspects of stress. Nevertheless, stress might also have positive effects, which should be considered as well in order to get a more holistic picture of what stress is. Stress is usually divided into two distinct categories - Eustress and Distress. Hereby, eustress is defined as the good stress, causing positive responses to the stressors (Simmons & Nelson, 2001). Eustress is considered as ‘a form of stress after which a person’s adaptive capacity increases' (Kupriyanov & Zhdanov, 2014). For instance, eustress can motivate and encourage us to perform and pursue a task, like for example writing an essay or engaging in physical exercise. In contrast to that, distress occurs as soon as we feel overwhelmed by stress. Actually, distress was found to be related to negative responses to stress, such as depression or burnout (The American Institute of Stress, 2019). In contrast to that, eustress did not demonstrate such a relationship (Kupriyanov & Zhdanov, 2014). Whereas eustress manifested itself as being related to health promoting behaviors, like sports, distress was found to be related to health threatening behaviors, like poor self-care, a lack of exercise, and as already stated, substance use (Hassanbeigi, Askari, Hassanbeigi, & Pourmovahed, 2013).

As already indicated, stress manifests itself in various phenomena and the consequences of distress can be severe. There is a lot of discussion and research about how stress develops. Stress can arise from various sources of different kinds and nature, like inter alia social, physical, emotional, or psychological. The World Health Organization emphasizes pressure and high work demands as common triggers of stress (WHO, 2019). More insight into how stress develops came from a study in 1994, which found a ‘positive correlation between locus of control and academic stress, suggesting that students with external beliefs are more stressed than those with internal’ (Abouserie, 1994). The result was confirmed by a further study, which was just recently conducted. Similarly, this study found that university students, who possessed external control beliefs, perceived more distress than their peers who had more internal control beliefs (Wiegner, Hange, Björkelund, & Ahlborg, 2015).

Interestingly, it was found that not only the locus of control influences the stress response, but that the general beliefs about stress significantly influence the stress response. Actually, it was found that stress beliefs constitute ‘a distinct and meaningful variable in determining the stress response’(Crum, Salovey, & Achor, 2013). To be more concrete, a study found that negative

stress beliefs predicted coronary diseases and even death (Nabi et al., 2013). A further study in 2016, confirmed this relationship by revealing that negative beliefs about stress predicted somatic complaints within the participants (Fischer, Nater, & Laferton, 2016). Consequently, it can be stated that it is not only the stressor itself, that causes a stress response, but the perception and the beliefs about stress. For instance, the belief that stress is bad is actually detrimental. The findings of all these studies suggest that the stress mindset, the individual internal evaluation of stress, might actually have a moderating function in relation to stress responses. This is a decisive factor to consider, in any exploration or intervention in the context of stress research. The findings of the studies are interesting for this research, since they might also explain why distress was found to be related to health threatening behaviors, like inter alia substance use (Hassanbeigi, Askari, Hassanbeigi, & Pourmovahed, 2013). Nevertheless, there is a lack of research on stress beliefs among university students. A further study found evidence that 'humans have the capability to modify what they perceive as stressful and how they respond to it' (Hannibal & Bishop, 2014). More concrete, they found that negative stress appraisals and evaluations were related to an exacerbate cortisol secretion. Hence, people who had negative stress beliefs were found to actually experience more stress, due to their increased cortisol level. As already suggested by Lovallo, in 2006, cortisol was found to increase the craving of substances, ultimately increasing the probability of substance consumption. Deriving from all these findings, it could be expected that negative stress beliefs are not only correlated with negative effects of stress as mental health complaints, but also positively correlated with substance use.

Generally, stress affects all social groups and all age groups. Nevertheless, there are periods in life in which people perceive more stress than usual. One of these life periods is the transition phase from puberty to adulthood. Many individuals are university students at this point in their life. During this phase, the individuals experience many essential changes and consequently challenges, which might be perceived in the form of stress. A study conducted in 2016 found that severe stress was represented among 33.8% of the student sample (Saeed, Bahnassy, Al-Hamdan, Almudhaibery, & Alyahya, 2016). The causes of stress among students can be related to their living situation. The unique challenges these individuals face are inter alia moving out from home, living alone for the first time, and finding new peer groups. Moreover,

universities are nowadays characterized by high workloads, which was already examined as a common trigger of stress. Nevertheless, the academic performance is not only a trigger for stress, but is also affected by the consequences of stress. A study in 2011, found that stress actually impaired the academic performance and development of students (Yusoff, Abdul Rahim, & Yaacob, 2011). Hence, students are caught in a vicious cycle of stress. Overall, the unique life situation of the students constitutes the major risk factor for the development of stress (Saeed, Bahnassy, Al-Hamdan, Almudhaibery, & Alyahya, 2016; Yusoff, Abdul Rahim, & Yaacob, 2011).

The unique life situation of students, makes them not only prone to stress, but also increases the risk to engage in substance use. Research has found that there are concerning patterns of substance use among students: 91.3% of a student sample consumed alcohol in the past year (Ayala, Roseman, Winseman, & Mason, 2017). According to the National Institute on Alcohol Abuse and Alcoholism (NIAAA), around 20% of college students, meet the criteria for an Alcohol Use Disorder (AUD). When comparing this value to the general population, this fact becomes alarming, because within the general population, only 6% met the criteria for AUD ("Alcohol Facts and Statistics," 2018). Substance use might have serious consequences. For instance, alcohol, tobacco and cannabis smoking, were found to be positively correlated with an increased risk of illness or injury (Milgrom & Burrows, 2001). Moreover, a further study found, that substance use was positively correlated with poor academic achievement (Cox, Zhang, Johnson, & Bender, 2007). Furthermore, a positive correlation was found between substance use and symptoms of depression as well as anxiety in a sample of university students (Cranford, Eisenberg, & Serras, 2009). In addition to that, substance use might lead to an addiction. This is especially detrimental, since substance use disorders are commonly known as having a high comorbidity with other psychiatric disorders (Milgrom & Burrows, 2001). All these negative consequences make clear that substance use should not be underestimated. As already indicated above, distress was found to be related to substance use (Hassanbeigi, Askari, Hassanbeigi, & Pourmovahed, 2013). This might explain why substance use is especially prevalent among students, since their unique life situation presents them with special stressors. Nevertheless, there is a lack of evidence for this assumption. Hence, there is a need for further investigation of this relationship. There is already some research that deals with the relationship between stress and

substance use. For instance, stress was found to be a major risk factor in the development of an addiction (Sinha, 2008). Moreover, it was found that the human body produces more cortisol, the stress hormone, during rehab (Lovallo, 2006). This increases the craving of the specific substance and hence promotes a further substance consumption. Hence, there are already some crucial insights in this relationship. Nevertheless, there is a high need for new scientific insights in this special topic and for the specific target group - students.

By now, it has become clear that negative thoughts and stress beliefs constitute a major factor in causing harmful stress responses, like substance use. This research aims to give insight in students' perceived level of stress, their stress beliefs and the prevalence of substance use among them. Moreover, the research intends to explore the relationship between these concepts. To be more concrete, the relationship between stress beliefs and substance use, as well as the relationship between perceived stress and stress beliefs will be examined. In favor of that, two research questions have been defined for this paper. The first research question was framed as 'What is the perceived stress, stress mindset and substance use of the students of the University of Twente?'. The second research question was: 'How is the perceived stress among students of the University of Twente related to substance use and how is this relationship moderated by the students' stress mindset?'.

Since stress and substance use are common social phenomena, which at some points pose serious risks for the population, the relationship between those two variables should be explored carefully. By clarifying this relationship, crucial information could be deducted, which might later constitute the basis for prevention or intervention programs. In 2015, a study found that alcohol, tobacco, and cannabis were the most prevalent substances. Actually, the worldwide prevalence of heavy consumption among the adult population, was 18,4% for alcohol, 15,2% for tobacco smoking, and 3,8% for cannabis (Peacock et al., 2018). Therefore, the current research focused on these three substances, but also considered other substances.

The hypothesis regarding the second research question suggests that the stress mindsets of the students of the University of Twente, moderates the impact of stress on their substance use, whereby students with more negative stress mindsets engage more in substance use.

Method

Design

A cross-sectional survey design was employed, by means of an online questionnaire. Here, stress was considered as the independent variable, whereby substance use was defined as the dependent variable. In order to measure substance use precisely, substance use was subdivided into four categories - tobacco, alcohol, cannabis, and other drugs. Hence, there were four dependent variables. Finally, the stress mindset constituted the moderating variable. Figure 1 portrays a schematic representation of the relationship between these variables.

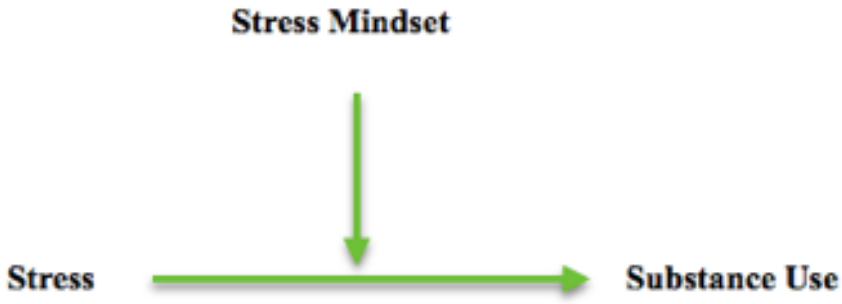

Figure 1. Schematic representation of the relationship between the independent variable Stress and the dependent variable Substance Use, with the moderating variable Stress Mindset

Participants

In total, 1328 participants volunteered their time for the completion of the questionnaire. Inclusion criteria for the participants was being a student of the University of Twente. The respondents were excluded from the study, if they did not complete all the relevant items of the current research. Moreover, participants who took less than ten minutes to complete the whole questionnaire, were deleted since the validity of their responses was in doubt. Out of the entire sample of students, 157 were excluded, since they did not meet the criteria. The final sample comprised 1171 valid respondents. Since the University of Twente provides education for 10.435 students, the sample of this research represents about 11.2% of the student population (University

of Twente, 2018). The respondents were students from all study programs registered full-time at the university. Table 1 represents additional relevant demographic characteristics of the respondents. The sample consisted of slightly more men (53.4%) than women (45.9%). As it can be deducted from the table, the majority of the participants was Dutch (71.6%), which was due to the fact that the University of Twente is located in the Netherlands.

Table 1

Demographic Characteristics of Participants, (N = 1328)

		Overall (n=1328)
Age	Mean (SD)	22.2 (3.02)
	Median [Min, Max]	22.0 [18.0, 48.0]
Gender	Male	709 (53.4%)
	Female	609 (45.9%)
	Other	10 (0.8%)
Nationality	NL - Netherlands	961 (72.4%)
	DE-Germany	142 (10.7%)
	Other	225 (16.9%)

Materials

In order to assess the research question, a questionnaire was developed. The final questionnaire that was used for the current research, consisted of 40 questions, which partly comprised subquestions. Nevertheless, not all questions, which were included in the final questionnaire, constituted themselves as relevant to assess the research question of the current study.

To assess the independent variable (stress), an already existing questionnaire was employed - the Perceived Stress Scale (PSS), developed by Sheldon Cohen in 1983. This fourteen-item questionnaire, constituted itself as the most common and reliable measurement of psychological stress (Lee, 2012). The questionnaire's aim was to investigate 'the degree to which individuals appraise situations in their lives as stressful' (Cohen, Kamarck, & Mermelstein, 1983). In favor of that, the participants were instructed to indicate their feelings and thoughts within the last month, on a 5-point Likert Scale from 'never' to 'very often' (Cohen, Kamarck, & Mermelstein, 1983). The items were formulated in an unspecific and general manner, e.g. 'In the last month, how often have you felt that you were unable to control important things in your life?'. A high score on this item, would imply high perceived stress. But, the PSS also comprised seven items, which were phrased positively, e.g. 'In the last month, how often have you felt that things were going your way?'. In contrast to the previous example, a low score here, would indicate a high stress level. Those items had to be reversed within the analysis of the data, in order to calculate the total score on the scale. The total score on the scale was obtained by summing up the scores on each sub question. Finally, the maximum score, which could be obtained in this PSS, was 56 and would indicate the highest possible perceived stress. A study conducted in 2008, used the 14 item PSS for their sample and divided the maximum score into quartiles, in favor of making sense of the data. They defined that a score above 28 would indicate moderate or severe stress levels (Amr, 2008). A further study, did the same and reported a mean of 30.84 within their student sample (Shah, Hasan, Malik, & Sreeramareddy, 2010).

The psychometric properties of the Perceived Stress Scale manifested themselves as acceptable. The value of Cronbach's alpha of the PSS, was found to lie between 0.84 and 0.86 (Cohen, Kamarck, & Mermelstein, 1983). Since a value between 0.7 and 0.95 is viewed as acceptable, it can be deducted that the measurement manifested itself as reliable (Tavakol & Dennick, 2011). Within the sample of this study, Cronbach's alpha of the Perceived Stress Scale was found to be even higher than that (14 items; $\alpha = .87$).

In order to measure the dependent variable (substance use), thirteen self employed items were taken into account. Each item dealt with a different drug (Cigarettes, Cannabis, Cocaine, MDMA, Speed, Heroin, Opium, Ketamine, LSD, Mescaline, Psilocybin, Methamphetamine,

Ritalin). The participants were instructed to indicate how often they have used each substance, by means of a 9-point Likert Scale from ‘never’ to ‘daily’. A high score on one of the scales indicates a frequent use of the certain substance. Moreover, a three item questionnaire for Alcohol consumption was taken into account. Within the questionnaire, a total score of 15 was the maximum score that could be achieved. By subdividing this score into thirds, a score above ten would indicate severe alcohol use, whereby a score below five would indicate mild alcohol use patterns.

Furthermore, the Stress Mindset Measure (SMM), was employed, in order to assess the possible moderator (stress mindset). This questionnaire consisted of eight items, formulated as statements about stress, e.g. ‘Experiencing stress facilitates my learning and growth’. Here, the participants should indicate the extent to which they agree or disagree with the statements, by means of a 5-point Likert Scale, from ‘strongly disagree’ to ‘strongly agree’. The total score on the SMM was obtained by summing up the scores of each sub question. A high score on the SMM indicates that the respondent considers the effects of stress as enhancing. In contrast with that, a low score on the SMM represents negative attitudes about the effects of stress. Cronbach’s alpha for the items of the Stress Mindset Measure, was .86 (Crum, Salovey, & Achor, 2013). Within the current sample, the Stress Mindset Measure was found to be reliable (8 items; $\alpha = .80$).

Finally, some items concerning the participants’ demographics were included in the survey. The participants were encouraged to indicate their age, gender, nationality, religion, and study program. Besides that, the students should also provide information about their sleep duration, and the amount of hours spend on classes at the university, as well as hours spent on studying, working and personal care. But, the demographics which were taken into account for this study, were limited to the age, gender and nationality of the respondents.

Procedure

The study has been approved by the Ethical Committee of the University where the research was conducted. After this, the researchers proceeded with the recruitment of participants via a distribution of the hyperlink of the Research & Experience software Qualtrics, a short

description of the research and an estimated duration of the questionnaire among all students studying at the University. This was executed by means of a recruitment mail, which was signed by the rector of the University of Twente. Once the participants followed the hyperlink in Qualtrics they were welcomed to the study and introduced to the background of the researchers who are conducting the study. The participants were informed about the research and a time frame of 20-25 minutes duration for the study was set. An informed consent was provided to each participant (Appendix 1) which assured that the involvement of the participants was on a voluntary basis and was subject to the certain conditions of the research. Moreover, it was reassured to the participants that they can withdrawn from the study at any time. Furthermore, the participants were informed about the anonymization and the confidential treatment of their personal data. The participants further had to indicate that they agree to participate and, thus, also agreed to the informed consent and were then led to the next page.

The following pages contained the questions for the various independent and dependent variables. The order of the various topics was randomly distributed. Finally, the participants were thanked for their cooperation and once again were provided with the contact details of one of the researchers and the study ended.

Data analysis

The first research question was examined by means of descriptive statistics. The descriptive data was analyzed by means of R studio. In order to test the hypothesis and answer the second research question, a moderation analysis was conducted. The moderation analysis was conducted in SPSS Statistics v24.

Firstly, the independent variable was derived by means of the sum-score of the Perceived Stress Scale. Hereby, it was crucial to score items 4, 5, 6, 7, 9, 10, and 13 in the reverse direction. Secondly, the mediating variable was similarly calculated in form of the sum-score of the Stress Mindset Measure. In favor of that, the four negative items of this measure, had to be reversed as well. Thirdly, Substance use was subdivided into four categories (Alcohol, Tobacco, Cannabis, Other Substances). Hence, there were actually four dependent variables. Moreover, the original nine substance use categories were combined into three subcategories: no/mild use, moderate use,

and severe use. No/mild substance use encompassed participants who reported that they used the substance once or never (1-3). Moderate use covered the people who use a substance once a month or less (4-6). Finally, Severe use portrayed participants who use a certain substance weekly or even daily (7-9). Since the questions regarding alcohol consumption were differently framed than the questions regarding other substances, a divergent method to analyze the alcohol data was taken into account. The sub scores on the scale were summed up to a total score. The average score on the scale was represented by the mean. Finally, because of the fact that Substance Use was subdivided into four dependent variables, four moderation models were taken into account - one for each dependent variable.

For Alcohol as the dependent variable, a normal linear regression analysis was conducted. Since Tobacco, Cannabis, and Other substances were subdivided into three categories, an ordinal logistic regression analysis was taken into account for each dependent variable. Ordinal logistic regression analysis was chosen since the subcategories (no/mild use, moderate use, severe use) had ascending values. By means of the regression analyses, it was investigated whether a relationship between stress and substance use exists and whether there was a moderating effect of the stress mindset on this relationship. In the first step, two variables were included in the regression analysis: stress and stress mindset. Moreover, each moderation model involved the employment of a categorical variable regarding one of the certain substances. Moreover, an interaction variable between stress and the stress mindset has been created and was added to the regression model. The results of the four moderation models were finally compared with each other.

Results

Table 2 presents descriptive data on all the relevant items for this research. Since some participants were excluded from the data analysis, the table represents demographic characteristics of the recent sample. The mean score of the Perceived Stress Scale was 27.3 (*SD* = 8.57), whereby the maximum score that could be obtained in this scale, was 56. Nevertheless, 43.98% of the sample scored above 28, which was the defined score to indicate moderate to severe levels of stress. Within the dataset, the minimum score on the PSS was found to be 4.00, whereas the maximum score was 52. Hence, the data demonstrated a range of 48 within the student sample. As shown in Table 2, the mean score of the stress mindset measure, was 12.7 (*SD* = 5.03). The range on this scale was found to be 29, whereby the minimum was a score of 0.0 and the maximum was a score of 29.0. The data regarding substance use was not normally distributed: Generally, there were less people who fell in the severe category, than people who fell in the no/mild or moderate categories, among all the substances. The majority of the students fell in the category of no/mild substance use. Out of the sample, 958 students reported no/mild use of Cannabis (81.8%). Moderate substance use was found to be most common in relation to Cannabis (13.9%). Finally, 50 people (4.3%) were found to engage in severe Cannabis use. Regarding Tobacco, there were even more people who reported to engage in no/mild use (85.0%). As presented in Table 2, it was found that 7.3% and 7.7% of the sample, respectively fell in the moderate or severe categories of tobacco use. The category ‘Other substances’ revealed a unique distribution of values. It was noticeable that 1169 out of 1171 respondents of the student sample, fell in the no/mild category of Other substances (99.8%). This constituted the category with the highest concentration of people. Regarding the moderate and severe use of Other substances, there was respectively only one person who reported to engage in frequent consumption (0.01%). Finally, with a mean of 7.14 (*SD* = 2.77), the majority of the participants fell in the center of the scale regarding alcohol use.

Table 2

Descriptive Data of the Final Data Set, (N=1171)

		Overall (n=1171)
Age	Mean (SD)	22.2 (3.08)
	Median [Min, Max]	22.0 [18.0, 48.0]
Gender	Female	534 (45.6%)
	Male	628 (53.6%)
	Other	9 (0.8%)
Nationality	Other	197 (16.8%)
	DE - Germany	136 (11.6%)
	NL - Netherlands	838 (71.6%)
Stress	Mean (SD)	27.3 (8.57)
	Median [Min, Max]	27.0 [4.00; 52.00]
Stress Mindset	Mean (SD)	12.7 (5.03)
	Median [Min, Max]	13.0 [0.00, 29.0]
Substance Use Cannabis	No/Mild use	958 (81.8%)
	Moderate use	163 (13.9%)
	Severe use	50 (4.3%)
Substance Use Tobacco	No/Mild use	995 (85.0%)
	Moderate use	86 (7.3%)
	Severe use	90 (7.7%)
Substance Use Alcohol	Mean (SD)	7.14 (2.77)
	Median [Min, Max]	7.00 [3.00, 15.0]
Substance Use Other	No/Mild use	1169 (99.8%)
	Moderate use	1 (0.1%)
	Severe use	1 (0.1%)

In favor of testing the hypothesis, four moderation models, one for each substance, have been conducted. The correlations appear in separate tables for each substance. As shown in Table 3, the normal linear regression analysis for the substance Alcohol as the dependent variable, revealed that there was no statistically significant effect of stress on substance use ($p < .06$). Moreover, no relationship between the stress mindset ($p < .31$) and Alcohol use, appeared. Finally, there was no moderation effect found for the interaction variable between stress and the stress mindset in relation to alcohol use ($p < .33$).

The ordinal logistic regression analyses of the other substances, demonstrated similar results. The model for Cannabis as dependent variable, represented in Table 4, neither showed a significant effect of stress on Cannabis use ($p < .28$), nor did it show a moderation effect of the stress mindset ($p < .41$). Finally, there was also no interaction effect of stress and the stress mindset ($p < .93$). As represented in Table 5, Stress also did not demonstrate a significant effect on Tobacco use ($p < .25$). Similarly, the stress mindset did not demonstrate any significant results ($p < .34$), nor did a moderation effect appear in regard to the relationship between stress and the stress mindset ($p < .82$). The same accounted for the investigation on Other substances. As shown in Table 6, ordinal logistic regression analysis demonstrated that stress did not manifest itself as related to the use of other substances ($p < .72$).

Generally, all moderation models were in line with each other. Contrary to the expectations, there was no moderating effect of the stress mindset on the relationship between stress and the use of all the substances, found. Hence, the hypothesis was rejected.

Table 3

Moderation model for the Substance Alcohol as the Dependent Variable

	Estimate	Std. Error	df	Sig.
(Intercept)	7.13	.69	1	.000
Stress	-.04	.02	1	.06
Stress_mindset	.05	.05	1	.31
Stress * Stress_mindset	.00	.00	1	.33

Table 4

Moderation model for the Substance Cannabis as the Dependent Variable

	Estimate	Std. Error	df	Sig.
Stress	.02	.02	1	.28
Stress_mindset	.04	.05	1	.41
Stress * Stress_mindset	.000	.00	1	.93

Table 5

Moderation model for the Substance Tobacco as the Dependent Variable

	Estimate	Std. Error	df	Sig.
Stress	.03	.03	1	.25
Stress_mindset	.05	.06	1	.34
Stress * Stress_mindset	.000	.00	1	.82

Table 6

Moderation model for Other Substances as the Dependent Variable

	Estimate	Std. Error	df	Sig.
Stress	-.10	.27	1	.72
Stress_mindset	-.11	.48	1	.82
Stress * Stress_mindset	.01	.02	1	.64

Discussion

Findings

The first research question of this paper, was defined as 'What is the perceived stress, stress mindset and substance use of the students of the University of Twente?'. Stress manifested itself as common among the student sample. A similar study conducted with students in 2010, had the same intention as the current study: to assess the perceived stress of a student population. The sample of the reference study manifested a mean score of 30.84 on the same scale (Shah, Hasan, Malik, & Sreeramareddy, 2010). Compared to this score, the students of the University of Twente demonstrated slightly lower levels of perceived stress. In contrast to the reference group, the cutoff score of 28, to indicate severe levels of stress, was not yet reached by the mean of the sample of the present research. This means that the students' stress levels can not yet be classified as high. Instead, the perceived stress level among the students of the University of Twente could rather be defined as moderate. But it should be considered that almost half of the student population scored above the cutoff score 28. Hence, this proportion of the student sample can be classified as very stressed. This makes this finding very important, since it calls for action in regard to stress reduction. Generally, the findings in regard to the PSS, were in line with the literature and other studies. As already indicated, the unique life situation of students exposes them to several challenges, which might be perceived in the form of stress (Saeed, Bahnassy, Al-Hamdan, Almudhaibery, & Alyahya, 2016). Moreover, many other researchers have already repeatedly written that stress levels manifested themselves as relatively high nowadays (Abouserie, 1994; Amr, 2008; Wiegner, Hange, Björkelund, & Ahlborg, 2015).

The results of the stress mindset measure were also in line with previous research. As already indicated, the sample demonstrated a slightly lower mean score on the SMM than the reference group. The researchers of the reference study, defined this score as debilitating (Crum, Salovey, & Achor, 2013). According to them, such a score represents negative attitudes towards stress, and consequently a negative stress mindset. For instance, a low score on the SMM indicates that the students consider the effects of stress as negative and as inhibiting learning and growth. Since the mean score of the present study was almost equivalent to the mean of the

reference sample, it could be concluded that the stress mindsets of the students of the University of Twente were negative. Hence, the students of the University of Twente perceive stress as inhibiting and think that stress should be avoided. To summarize, the results regarding stress and stress mindset, were both in line with each other: The stress level was temperately high and the stress mindsets were negative. According to previous research, this mixture of conditions is detrimental. For instance, a study in 2014 suggested that negative stress mindsets increase the perceived level of stress. Moreover, negative stress mindsets were found to cause negative stress responses (Hannibal & Bishop, 2014). Consequently, the students of the University of Twente could be considered as being at risk for negative stress responses, like inter alia depression or substance use. Since those stress responses might have severe consequences, as already indicated in the beginning of this paper, there is a need for action. The findings regarding the stress mindset should be carefully considered, when designing possible prevention and intervention programs for the students of the University of Twente.

An interesting finding of this study was the substance use behavior of the students of the University of Twente. Their substance use patterns manifested themselves as similar among all the substances asked for, in the questionnaire. As indicated in Table 1, the majority of the students was classified in the no/mild category of substance use. This means that the majority of the students reported that they have used a substance once or never. This was actually true for all four categories (alcohol, tobacco, cannabis, and other substances). The result was surprising, since it was not in line with findings of previous studies like the research conducted by Peacock et al., 2018. They already revealed alarmingly high numbers of heavy substance consumption among young adults. For instance, the study found that more than 15% of the sample engaged in daily tobacco smoking (Peacock et al., 2018). Since the majority of the students of the University of Twente were young adults, it was expected that substance use scores would be similarly high. But, the findings of the current study did not meet the expectations in this regard. Especially in regard to severe tobacco smoking, it was expected that the values would be much higher. Within the sample of the current study, only 7.7% were found to engage in severe tobacco use. Nevertheless, in contrast to the reference study, severe tobacco users within the current sample, did not only include students who used tobacco daily, but also included students who used

Tobacco once a week or several times a week. Hence, the percentage of daily smokers was even lower than 7.7% in the student sample of the University of Twente. This value actually constitutes only half of the reference value. It is possible that this deviation was due to the fact that the present research had a very specific target group: students of the University of Twente. In contrast to that, the sample of the reference study consisted of young adults in general. The University of Twente is already very welcoming and ambitious to provide their students a healthy learning environment. In favor of that, they tried to counteract smoking by means of prevention programs like inter alia smoking bans. The University of Twente even announced that the whole campus will be smoke-free next year (University of Twente, 2019). Considering the relatively low prevalence of smoking among the students of the University of Twente, it might be possible that the prevention programs had positive effects.

To summarize and to provide a concise answer to the first research question, it can be stated that the perceived stress among the students was on a relatively temperate level. The stress mindset was found to be rather negative, but substance use manifested itself as lower than expected. The majority of the students reported that they used substances seldom.

The second research question of the current research was defined as ‘How is the perceived stress among students of the University of Twente related to substance use and how is this relationship moderated by the students’ stress mindset?’. The ordinal logistic regression analysis revealed that there was neither an effect of stress on substance use, nor a moderation effect of the students’ stress mindset. In other words, the results have shown that the students’ perceived stress was not related to substance use, and that stress mindset did not appear to have an effect on one of these constructs. This finding contradicts the study done by Hassanbeigi, Askari, Hassanbeigi, & Pourmovahed, 2013, which reported that stress was related to substance use. Nevertheless, the current study found that there was actually no significant relationship between perceived stress and substance use. It is possible, that this might also be due to the fact that the current study had a different target group. Unlike the study of Hassanbeigi, Askari, Hassanbeigi, & Pourmovahed, 2013, the sample of the current study, consisted entirely of students of the University of Twente. As already indicated in the beginning of this paper, students have a unique life situation. Most literature suggests that substance use has a stress relieving

function. Nevertheless, most students engage in substance use due to parties or activities that are not stress related. Such events constitute the main exposure to drugs among students. It is scientifically known that the exposure to drugs increases the risk to actually engage in substance use (Bezinović & Malatestinić, 2009). Hence, it could be concluded that substance use among students is rather related to social issues than aimed at stress relief. Deductive, students might engage more often in substance use when their stress level is low. In contrast to that, when stress is high, the student would be less likely to go to a party or social event, which would expose them to substances. Generally, this assumption would be in line with the findings of the current research. The results indicated that the perceived stress was on the higher end of a temperate stress level. In contrast to that, substance use was not very common among the students of the University of Twente. Maybe substance use would be more prevalent during stress-free periods, since students would have had less academic stress. Hence, they would have had more time to engage in social activities, like parties, which would expose them to drugs and finally increase the risk to engage in substance use. Nevertheless, further exploration in this regard is in need.

Strengths and Limitations

On the one hand, the current study emphasized some remarkable strengths. Firstly, this research has a great usefulness since it provided some first insights into the current issues of the students of the University of Twente. This research constitutes the first large-scale research to assess stress, stress mindsets and substance use among the students. Hence, the results of this study provide new scientific insights in the unique situation. Moreover, the results of this research will be used to design an UT-action plan towards student wellbeing. Secondly, the sample size of the current study was large. Even after the cleaning of the data set, the participants of the research represented 11.2% of the whole student population. This sample size enriched the accuracy of the statistical data and consequently reduced the margin of error.

On the other hand, this study possessed some weaknesses, which are in need of consideration. The questionnaire itself comprised some limitations. Firstly, not all the questions, included in the final questionnaire, constituted themselves as relevant to assess the research question of the current study. Consequently, the initial questionnaire comprised more items than

actually necessary for this research. The fact that the questionnaire was longer is not necessarily bad. But, the associated increased duration to fill in the questionnaire might have affected the motivation and concentration span of the participants. It is possible that this promoted a desultory completion of the questionnaire. Therefore, it is crucial to consider the fact, since this might have distorted the results by undermining the validity of the answers. Secondly, although the method of an online survey manifested itself as very efficient, there was no control over the conditions in which the questionnaires were completed. As a result, external influences like inter alia noise distractions, might have affected the responses of the students. Thirdly, the recruitment of the data was during exam period of the University of Twente. During exam period, most students experience an increase of academic stress due to assignment deadlines and enhanced workloads. This means that the students' stress level during that time, was probably higher than usually. Nevertheless, the perceived stress level of the student was still lower than the reference group. Still, it can not be ruled out that this might have affected their responses, and finally manifested itself in the form of higher perceived stress levels than usually. Fourthly, the scales included in the questionnaire were all quite unspecific. Mainly the brief versions of the scales were taken into account as the measurement for the demanded constructs. Hence, the results of this measurement were limited in their informative value. For instance, the Perceived Stress Scale (PSS) was a very broad tool to assess the stress levels of the students. The PSS does not focus on special stresses, i.e. academic stress, but measures stress in a very general manner. It is interesting to note that it might be possible that a more detailed measurement of stress would provide more significant results. For instance, the Student-life Stress Inventory (SLSI), would constitute a more detailed and reliable measurement of stress among the student population of the University of Twente. Fifthly, a further limitation of this study was the cross sectional survey design. The results especially lacked temporal insights in the students' issues. Prospective longitudinal studies are needed to gain further insights in the topic. In favor of that, a longitudinal study would reveal unique developmental trends or variable patterns across the time. Moreover, further insights in the cause and effect relationships could be derived by means of longitudinal studies. Finally, some external factors should be taken into account when interpreting the results of this study. It is crucial to consider the fact that, in contrast to many other countries, Cannabis is tolerated in the

Netherlands. As indicated in Table 4, more than 13.9% fell in the moderate use category of Cannabis use. It might be the case that the amount of people who reported to engage in Cannabis use, was slightly higher, compared to studies conducted in countries where Cannabis has an illegal status.

Further Research

As already stated, it is recommended to employ prospective longitudinal studies. Further research should repeat this study on a regular basis, in order to check for fluctuations at different points of time and to provide more insight in the topics investigated in the current study. There is a need to investigate the causes of stress and to identify external and internal influences. Moreover, the stress mindsets should be explored more in depth. In addition to that, for future research, the questionnaire should be adjusted, especially in regard to the included scales. Finally, it is highly recommended to take the results of this study into account, when designing possible prevention and intervention programs for the students of the University of Twente. Since some of the obtained values suggested a soon transgression to higher levels of stress and substance use, there is a need for action. As already indicated in the beginning of this paper, the consequences of severe stress and substance use might be cruel. Therefore, everything within the capabilities of the University of Twente, should be done to counteract and prevent this development. It is recommended to use the results of this research to accomplish an action plan towards student wellbeing at the University of Twente.

Conclusion

This study investigated the relationship between stress and substance use among students of the University of Twente. Moreover, this research explored if a moderating effect of the stress mindset on the relationship between stress and substance use, exists. The results of this study revealed that the students' perceived stress was not related to substance use, and that stress mindset did not appear to have an effect on one of these constructs. Generally, the results of this study call attention to the issues the students of the University of Twente are facing. Although, none of the values manifested itself as alarmingly high, the results of this study should not be underestimated. It is crucial to consider that the students' scores on stress and substance use presented worrying tendencies to exceed to higher levels. Moreover, it was found that stress mindsets among the students of the University of Twente were rather negative. Previous research found that negative stress mindsets predict detrimental consequences of stress. Although the current research found that the stress mindset did not have an effect on substance use, it might be that the stress mindset had an effect on other constructs, which were not assessed within this research. Therefore, it is important to take action now and to conduct more research in this regard. Furthermore, the University of Twente should address the challenges the students face (especially in regard to stress), by means of an action plan toward student wellbeing. The present paper gave some first useful scientific insights in the conditions of the students of the University of Twente. Hence, it constitutes a stable base for the conduction of further research on the topic.

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Appendix A

Informed consent

Before you proceed in this questionnaire, please read the informed consent information below. Please be aware that your participation in this study is completely voluntary, and that you can stop taking part at any time. You may also withdraw from this research at any point until one week after submitting the survey. Under no circumstances will your real name or personal information be included in the report of this research. Nobody, except the four researchers and the research supervisor, will have access to the anonymized material. Your data will be treated confidentially and the research results will be published anonymously. Your personal data will not be given to third parties without your permission. If you have any questions, you may contact Leonie Reh (l.reh@student.utwente.nl).

If you have any complaints about this research, please direct them to the secretary of the Ethics Committee of the Faculty of Behavioural Sciences at the University of Twente, Drs. L. Kamphuis-Blikman P.O. Box 217, 7500 AE Enschede (NL), telephone: +31 (0)53 489 3399; email: l.j.m.blikman@utwente.nl).

If you click on 'proceed', you indicate that you have read and understood the informed consent, and have been informed in a manner which is clear to you about the nature and method of the research. By proceeding you agree with participating in this study.

□ I agree to participate