June 28th, 2021

Are you satisfied? The role of basic psychological need satisfaction in the perception of stress in university students – an experience sampling study

Bachelor thesis

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Abstract

Objective: The goal of this study was to explore the associations between basic need satisfaction and perceived stress on a daily level in university students. **Method:** An online experience sampling study using repeated measures was conducted. 63 participants agreed to participate, 46 were included in the final sample. Perceived Stress Scale (PSS-10) was used to measure trait stress, the Basic Need Satisfaction in General Scale (BNSG-Scale) was used to measure trait basic need satisfaction. Stress numerical rating scale-11 (Stress NRS-11) was used to measure state stress, items were selected from the BNSG-Scale were used to measure state basic need satisfaction. The collected state data was analysed using Linear Mixed Models, the trait data using Linear Regression. **Results:** Weak to very weak negative associations were found between basic need satisfaction and stress both on state and trait level. A similar association was found between stress and the subscales competence, autonomy, and relatedness on a state level. **Conclusion:** The current study provides new evidence for the associations between state basic need satisfaction and perceived state stress. Specifically, negative associations between basic need satisfaction and perceived stress were found both at a state and trait level. The obtained correlations could have implications in the educational system, particularly in the design and implementation of study programs at universities. At last, this study provides a good basis for further research, by the creation of a state basic need satisfaction scale using the experience sampling method to measure state basic need satisfaction over the course of a week.

Keywords: experience sampling method, basic need satisfaction, perceived stress, university students, state measure

Are you satisfied? The role of basic psychological need satisfaction in the perception of stress in university students – an experience sampling study

To experience stress in one's everyday life could be thought of as an international problem that can affect anyone regardless of their socioeconomic status, heritage, or lifestyle. In 2017, 37 % of the participants of an online survey stated that their stress levels increased over the past year (Aon, 2017). Another study (n=1002) has shown that 43.8 % of the questioned students experience very to extremely much stress (Erasmus Student Netwerk, Landelijke Studenten Vakbond, & Interstedelijk Studenten Organisatie, 2019). Furthermore, in a study conducted at the University of Twente, the students indicated high levels of perceived stress compared to average stress levels at other universities (Kelders, Oberschmidt, & Bohlmeijer, 2019).

A variety of factors that might predict stress in students have been suggested over the years (Dusselier, Dunn, Wang, Shelley il, & Whalen, 2005; Eberhart & Hammen, 2009; Helmbrecht & Ayars, 2021; Saleh, Calmart, & Romo, 2017; Seedhom, Kamel, Mohammed, & Raouf, 2019). Another factor that might influence the perception of stress in university students could be the satisfaction of basic psychological needs. That statement could be substantiated by Ryan & Deci (2000) claim that the basic need satisfaction (BNS) is crucial for the well-being and development of students. The Self-Determination Theory (SDT) approaches human motivation and personality by using established empirical methodology as well as an organismic metatheory, which emphasises the significance of developed internal resources for the development of personality and behavioural self-regulation (Ryan, Kuhl, & Deci, 1997). At the heart of SDT is the Basic Psychological Need Theory proposing that humans possess three basic needs, namely the need for competence, autonomy, and relatedness (Deci & Vansteenkiste, 2004).

Since stress might not be stable over time, a useful approach could be to measure stress and basic psychological need satisfaction on a daily level. To do so, this study will make use of the Experience Sampling Method (ESM). ESM is a research method that is characterised by having participants fill out self-report measures across multiple days, with the distinction that in ESM studies participants are reminded throughout the day to complete the assessments (Larson & Csikszentmihalyi, 1983). A variety of ESM studies, investigating stress or various aspects of basic psychological need satisfaction, were conducted in the past years (Prentice, Jayawickreme, & Fleeson, 2020; Wang, Zhu, Dormann, Song, & Bakker, 2020; Vandercammen, Hofmans, & Theuns, 2013; Kumar, & Kaur, 2019; Campbell, Vansteenkiste, Soenens, Vandenkerckhove, & Mouratidis, 2021). Even though research in basic need satisfaction seems to increase, no study was found that investigates the relationship between the satisfaction of the three basic needs and perceived stress in university students using ESM. Hence, a research gap could be identified regarding the role of BNS in levels of perceived stress of students in daily life, which will be the general topic of this study.

Perceived stress

When speaking of stress, one must differentiate between two meanings: stress exposure and stress response (Harkness & Hayden, 2020, "Stress Defined", para. 1). To begin with, stress exposure can be described as being exposed to occurrences or challenges in one's environment (Dohrenwend & Dohrenwend, 1974). In comparison, stress response is regarded as the response of an individual to stress exposure (Harkness & Hayden, 2020). Moreover, the specific response to any stress exposure is determined by a variety of factors (e.g., genetic vulnerability, personality, temperament and many more) (Harkness & Hayden, 2020).

A stress response is by definition subjective, since how one individual appraises the exposure of a stressful event can drastically differ from how another individual might evaluate the same situation (Harkness & Hayden, 2020). This study will thus focus on the stress response, namely on an individual's perception of his/her stress response. The perception of stress response could also be described as the concept of perceived stress, hence the perception of an individual of their stress level. The perception of stress is likely to occur when an individuals perceived internal and external pressures are estimated as being too much to cope with. This can then overload one's capacity resulting in the person perceiving the situation as threatening, in other words, as stressful (Maajida Aafreen, Vishnu Priya, & Gayathri, 2018).

On the other hand, not just the perception of stress but also the impact this can have on the health behaviours and self-perceptions of students is a topic worth discussing. Hudd et al. (2000) investigated the effects of stress in college students on health habits, health status and self-esteem. Their findings suggest that students that experience stress were not as likely to engage in healthy behaviours (exercise, sufficient sleep, eating healthy) and were more prone to execute bad habits (alcohol consumption, junk food, risky sexual behaviour). Additionally, students that experienced greater stress seemed to also show lower levels of self-esteem as well as a diminished judgement of their health status. The explanation that Hudd et al. (2000) gave for their findings were that college often is a time in which one must create new social support systems which by itself can already be a stressful task. Underlying their somewhat outdated findings are the results of a study by Dalton & Hammen (2018) in which the relative effects that stress might have on depressive symptoms and affect were investigated in 127 undergraduate university students. These indicate that chronic stress might have a significant positive association with maladaptive health behaviours (unhealthy

eating, insufficient sleep, and substance use), as well as persons experiencing daily stress portraying more same-day maladaptive health behaviours.

It has been suggested that individuals might have difficulties to accurately recall their past stress perceptions (Ellison et al., 2020). Hence, some researchers have used ESM to investigate associations between daily perceived stress and other psychological concepts. For example, a study by Tschacher and Lienhard (2021) investigated the link between mindfulness and affectivity as well as mindfulness and stress in daily life and suggested associations between mindfulness and stress in daily life. The concept of perceived stress in daily life has been examined in a variety of different contexts. For example, the relation of daily stress and sleep (Engert et al., 2018), the efficacy of the use of ESM to measure stress (and other concepts) in forensic psychiatry patients (Habets, Delespaul, & Jeandarme, 2021) as well as others were investigated (Chan et al., 2018; Gloster et al., 2020; Van Eck & Nicolson, 1994).

Three basic needs satisfaction

It has been suggested by a variety of studies, that BNS might predict perceived stress (Breaugh, 2020; Neufeld, Mossière, & Malin, 2020; Naylor 2020). Ryan (1995) described basic psychological needs as behaving like a source of nourishment that is indispensable for an individual's integrity and development. In the Basic Psychological Need Theory, one differentiates between the satisfaction of needs and the frustration of needs (Vansteenkiste & Ryan, 2013). Likewise, it is particularly important to differentiate between low need fulfilment and actual need frustration. This is mainly since, while low need fulfilment might fail to facilitate the growth of an individual, the frustration of a need often leads to defensiveness and even ill-being or psychopathology (Bartholomew, Ntoumanis, Ryan, Bosch, & Thøgersen-Ntoumani, 2011; Ryan, Deci, Grolnick, & La Guardia, 2006; Vansteenkiste & Ryan, 2013).

The satisfaction of the three basic needs, namely autonomy, competence and relatedness is thought to be essential for any individual to be able to engage with their environment as well as for it to want to engage (Ryan & Deci, 2004). The need for autonomy can be understood as an individual feeling a sense of choice, recognition, or affirmation in a task. Competence describes the need to feel confident and effective in their actions. Lastly, relatedness amounts to one having a feeling of being connected to his/her peers in a social environment (Ryan & Deci, 2004).

Deci and Ryan (2008) stated that the needs for autonomy, competence and relatedness are essential for an individual to perform efficiently as well as for their psychological health and well-being. Specifically, the satisfaction of these needs is thought to be indispensable in a student's thriving, growth, and well-being (Deci & Ryan, 2000).

Furthermore, van den Broeck, Vaansteenkiste, De Witte and Lens (2008) indicated that an individual whose needs are satisfied might be more likely to feel vigorous. As a matter of fact, another study by Vansteenkiste, Lens and Deci (2006) suggested something similar, namely that individuals with fulfilled needs are to a greater extent motivated than individuals which needs are not satisfied or even frustrated. Hence, the basic psychological need satisfaction seems to be linked to well-being. This claim was thoroughly investigated by multiple studies in a variety of different fields (e.g., sport, work, health care, psychotherapy, and education), leading to the establishment of an empirical link between basic psychological need satisfaction and well-being, both on a daily and general level (Gagné, Ryan, & Bargmann, 2003; Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Ryan, Bernstein, & Brown, 2010; Ryan & Deci, 2000; Sheldon & Niemiec, 2006). Another more recent study investigated the possibility of BNS moderating the link between higher socioeconomic status and better mental and physical health and suggested that BNS could act as a moderator in this relationship (González, Swanson, Lynch, & Williams, 2016).

How is Basic needs satisfaction linked to stress?

Previous research investigating the link between BNS, and perceived stress suggests a predicting effect of BNS for stress (Naylor, 2020). Similarly, Weinstein & Hodgins suggest that BNS might act as a defensive response that helps to regulate and maintain positive outcomes subsequently to stress exposure. Moreover, a study conducted by Breaugh (2020) found that relatedness seems to moderate the relationship between stress and work engagement. Hence, relatedness seems to lessen the negative effect that stress has on work engagement.

Likewise, Neufeld, Mossière, and Malin (2020) examined the influence mindfulness, resilience and BNS has on perceived stress levels in medical students. The results of their analysis showed a negative association between BNS and perceived stress, thus indicating a stress-protective role of BNS in students (Neufeld, Mossière, & Malin, 2020). Additionally, Naylor (2020) findings indicate that the satisfaction of the three basic psychological needs plays a role in predicting stress in university students. Unfortunately, Naylor (2020) did not make use of ESM which might limit the applicability to the present study. Similarly, it was found that increased levels of academic stress during the exam period are associated with lower levels of the need for autonomy as well as poorer sleep quality (Campbell, Soenens, Beyers, & Vansteenkiste, 2018).

Furthermore, several studies found that job control, as well as social support from one's peers and supervisors, can affect the management of stress positively (Hamann & Foster, 2014; Karasek & Theorell, 1990; Noblet & Rodwell, 2009). Job control could be interpreted as the need for autonomy and social support as the need for relatedness. Nonetheless, little to no research exists concerning whether the same effect occurs in university students. At last, Weinstein and Ryan (2011) stated that environments that

encourage the satisfaction of basic needs are associated with lesser stress incursion, that is the probability of experiencing stress and the associated negative physiological response.

Since the link of BNS and perceived stress on a daily level in university students seems to be a neglected area in the field of SDT and stress research, some concepts generally thought to be related to stress will be included and connected to indicate possible areas of interest. It has now been suggested that there might be a significant association between lack of resources, high academic demands, and student burnout (Salanova, Schaufeli, Martínez, & Bresó, 2010). Burnout could be described as a psychophysiological response to chronic stress exposure, often described as emotional and physical exhaustion (Raedeke & Smith, 2001).

Lack of resources and high academic demand might be related to the need for competence since if a student does not possess sufficient resources, he/she might not be able to deal with the workload, which might potentially lead to low satisfaction of the need competence. Underlining this assumption are the findings of two studies that suggest that low levels of need satisfaction are related to higher levels of burnout symptoms (Hodge, Lonsdale, & Ng, 2008; Perreault, Gaudreau, Lapointe, & Lacroix, 2007). However, these results were obtained in professional athletes, which might limit the applicability to the present study. A study investigating the link between burnout, stress, BNS as well as low leisure-time physical activity showed results that were in line with the previously presented research while expanding some of the previous findings (Gerber, Isoard-Gautheur, Schilling, Ludyga, Brand, & Colledge, 2018). More specifically, a moderate to strong association between stress and low basic need satisfaction and high burnout scores was found (Gerber et al., 2018). These findings elaborate on Hodge et al. (2008) as well as Perreault et al. (2007) by including measures of perceived stress and presenting a correlation between stress and basic need satisfaction. Nonetheless, a limitation of Gerber et al. (2018) could be identified in

the lack of daily life measures, which would provide a clearer picture of the indicated negative association.

Previous work has been limited to the investigation of the association between basic psychological need satisfaction and perceived stress on a trait level. A neglected area of research is the role BNS plays in the perception of stress in the daily life of university students. Thus, it seems that this specific area remains unclear, which indicates a knowledge gap. Thus, this study will aim to provide a better understanding of the relationship between state basic need satisfaction and state perceived stress. To achieve this, the following explorative research questions were formulated:

RQ1: How do daily changes in basic need satisfaction associate with perceived stress in university students in daily life?

RQ2: How well does Basic Need Satisfaction predict perceived stress in the daily life of university students?

Methods

Design

This study made use of ESM, which enables the researcher to study actual experiences in the environments in which they naturally occur (Myin-Germeys et al., 2018, p.123). It further applied a within-subject design and self-report questionnaires, which had to be filled in three times a day over the course of a week. The data was collected on the platform Ethica (Ethica data, 2021) in April 2021 in order to conduct multiple surveys a day. This study obtained ethical approval from the Behavioural, Management and Social Sciences Ethics Committee of the University of Twente. Additionally, informed consent was collected online before taking part.

Participants

For this study the researchers chose convenience sampling, this was done by using the Test Subject Pool System of the University of Twente (SONA) as well as by reaching out to peers via social media platforms. The participants were English proficient students who owned a smartphone with an Android or iOS operating system and were able to install the Ethica application. A total of 63 participants agreed to take part in this study. Participants that did not manage to complete trait measures, as well as state measures with a response rate of less than 60 %, were excluded, resulting in a sample of 46 subjects.

Materials

Since this study was conducted in cooperation with two other bachelor students for convenience reasons, the test battery also included two questionnaires assessing neuroticism and emotion-focussed coping, which will not be discussed further.

Ethica

Ethica (Ethica data, 2021) is an online platform with an accompanying mobile application. By using Ethica, researchers can create mobile studies, which can be completed thoroughly on the participants' mobile devices. It enables the researcher to screen participants for eligibility and obtain informed consent without having to set up a physical meeting. The participants received a link as well as a study code that enabled them to take part in the study.

Trait measures

The Basic Needs Satisfaction in General Scale (BNSG-S) was used to assess the trait BNS at the beginning of the study (Deci & Ryan, 2000; Gagné, 2003). All subscales, autonomy, competence, and relatedness were used in this study. The questionnaire (see Appendix A) consists of 21 items, seven of which measure autonomy, six competence and eight relatedness. The questionnaire made use of a seven-point Likert scale ranging from one (“not true at all”) to seven (“very true”).

To assess trait stress, the ten-item version of the Perceived stress scale (PSS) (Cohen, Kamarck, & Mermelstein, 1983) was used (see Appendix B). The participants were asked to indicate how often they felt or thought a certain way on a four-point Likert scale ranging from one ("never") to four ("always").

Furthermore, to assess the reliability of the BNSG-S and the PSS the Cronbach's alpha was calculated for these scales. For the trait BNSG-Scale, Cronbach's alpha of .673 was found, indicating medium reliability. Previous research found a Cronbach's alpha of .89 (Gagné, 2003).

Finally, for the trait Perceived Stress Scale, a Cronbach's alpha of .934 was found, indicating a very high reliability in this sample. Likewise, Mitchell, Crane, and Kim (2008) found a Cronbach's alpha of .91for this scale.

State measures

To assess state BNS, three items were selected from the BNSG-S, one to measure autonomy ("I feel like I can pretty much be myself in my daily situations. "), one for competence ("Most days I feel a sense of accomplishment from what I do. ") as well as one item for relatedness ("People are generally pretty friendly towards me. ").

To measure state stress, the Stress Numerical Rating Scale was selected (see Appendix C) (Karvounides, Simpson, Davies, Khan, Weisman, & Hainsworth, 2016).

Procedure

Previous to the publishing of the study, a pilot test was conducted by the researchers to check whether everything was set up correctly. After the study was published, an invitation was sent to peers stating all the necessary information (invitation link, duration, and requirements), the same information was made available on the Test Subject Pool System of

the University of Twente (SONA). Students from the University of Twente who registered via the Test Subject Pool were rewarded with 1.5 credit points.

To participate in this study, participants were asked to create an account on Ethica with their email address and download the application. After registration, the participants were asked to fill in informed consent (see Appendix D), some demographic questions, as well as the first questionnaires to measure trait levels. During the following seven days (excluding the day of registration) the participants were asked to fill in identical surveys three times a day (9:00-10:30; 14:00-15:30; 20:00-21:30). The daily questionnaire consisted of eight questions, hence the participants needed approximately three minutes three times a day to fill in the surveys. Furthermore, the subjects received a notification every time the questionnaire needed to be answered. Whenever a participant did not fill in one of the three daily assessments, he/she received a reminder after 30 minutes as well as one after 1 hour, asking to please fill in the questionnaire. If the participant did not complete the assessment in the previously mentioned timeframes, a missing value was attributed.

Data Analysis

Once the process of data collection was completed, the data was exported from Ethica via a CSV file and then imported into SPSS. Subsequently, individuals with a response rate lower than or 60 % were excluded from the analysis. Additionally, the alpha level for the entire analysis was set to $< .05$. Afterwards, descriptive statistics (Means, SD) were calculated for demographic data, state, and trait BNS, trait stress and state stress.

To investigate the association between trait stress and trait BNS, a linear regression analysis was conducted, trait stress being the dependent variable and trait BNS the independent variable. To assess the association between state stress and state BNS, a linear mixed model was performed. Prior to the analysis, state BNS and state perceived stress were standardized. At first, state BNS was chosen as the independent variable and state stress as

the dependent one. Subsequently, BNS was split into three independent variables (autonomy, competence, and relatedness), with state stress as a dependent variable. Furthermore, three separate linear mixed models were performed for each subscale of BNS. All variables have been standardized beforehand. This was done to investigate whether there was a relationship between state stress and individual basic needs.

Results

Participant Flow

This study had 63 participants that agreed to partake. Furthermore, individuals with a response rate of less than 60 % were excluded from the study, hence were not included in the data analysis. After excluding the cases that did not meet the inclusion criteria, a sample of 46 participants was used for analysis.

Descriptive statistics

The ages of the participants ranged from 19 to 27 years (M = 21.13, SD = 1.833). Additionally, 82.6 % of the participants reported their gender as female, 17.4 % as male. The final sample included six different nationalities, specifically 67.4% Germans, 21.7% Dutch, 4.3% Romanians, 2.2% US Americans, 2.2% British and 2.2% Italian. Overall, a total of 1.104 state measurements, as well as 46 trait measurements, were collected. Descriptive statistics for trait and state measurements as well as for the subscales of the BNSG-S are presented in Table 1.

Table 1:

Minimum, maximum, means, standard error and standard deviations for trait and state measures of the final sample (N=46).

	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Error	Std. Deviation Statistic
Trait BNS	2.95	5.90	4.79	.022	.669
Trait stress	.30	4.00	1.95	.027	.832
State BNS	.67	7.00	5.14	.038	1.106
State Competence	0	7	4.42	.053	1.557
State Autonomy	0	7	5.27	.044	1.310
State Relatedness	0	7	5.76	.038	1.120
State stress	0	10	3.05	.086	2.529

Trait stress and Trait BNS

The assumed correlation of trait stress and trait BNS was examined using linear regression analysis. Next, a scatterplot with a fitted regression line (Appendix F) was plotted to investigate the association of the two variables. Through visual inspection of the plot, a negative linear association could be assumed. Additionally, trait stress statistically significant predicted trait BNS (F (1, 44) = 22.42; $p < .001$; R-squared = .343; B = -.997; t = -4.74).

State Stress and State BNS

A standardized linear mixed model analysis was used to investigate the possible association of state BNS and state stress. The analysis indicated that state stress statistically significant predicts state BNS, F (1, 729.209) = 76.21, $p < .001$. The results showed that there is a very weak negative association between state BNS and state stress, $\beta = -.13$, SE = .0153 $p < .001$.

Furthermore, three separate Linear Mixed Models were executed to further investigate the possible association between state competence, state autonomy, state relatedness and state

perceived stress. The resulting parameter estimates can be found in Table 2. The analysis showed that there are statistically significant weak negative associations between state Competence and state perceived stress ($F (1, 730.101) = 37.82$, $p < .001$) as well as between state Autonomy and state stress ($F (1,725.112) = 60.49$, $p < .001$). The investigation of the association between state relatedness and state perceived stress showed similar results, specifically a statistically significant very weak negative association, $F (1, 727.540) = 18.63$, $p < .001$.

Table 2:

Standardized β, standard error, confidence intervals and significance for state BNS and its three subscales in the final sample

			95% confidence interval		
	β (standardized)	Standard error	Lower	Upper	Significance
State BNS	-.13	.0153	-.17	-.10	<.001
Competence	-.10	-0167	-.14	-.07	<.001
Autonomy	-.15	.0189	-.18	-.11	<.001
Relatedness	-.08	.0187	-.12	-.04	<.001

Individual Graphs

Additional to the Linear Mixed Models that were conducted to investigate the correlation between state perceived stress and state BNS, an exploratory approach was chosen to take a closer look at fluctuations in stress and BNS levels over time. This was done by plotting individual multiple line graphs and examining in which way state perceived stress behaves in relation to state BNS.

Low Perceived Stress, high Basic Need Satisfaction. One Participant portraits high trait BNS (124; SUM-scored) as well as low perceived stress (12; SUM-scored). More precisely, the participant also scored high on trait autonomy (39), competence (37) and relatedness (48). In the state measurements, this participant also scored considerably high on BNS and somewhat low on perceived stress (see Figure 1). During many timepoints, one can see the weak negative association between BNS and perceived stress (4-5, 6-7, 8-9, 9-10, 13-14, 14-15, 15-16, 18-19, 19-20). To give an example, during the increase in perceived stress (0-2) in timepoint 8-9 one can see a decrease in BNS (6.67-5.67; Mean-scores).

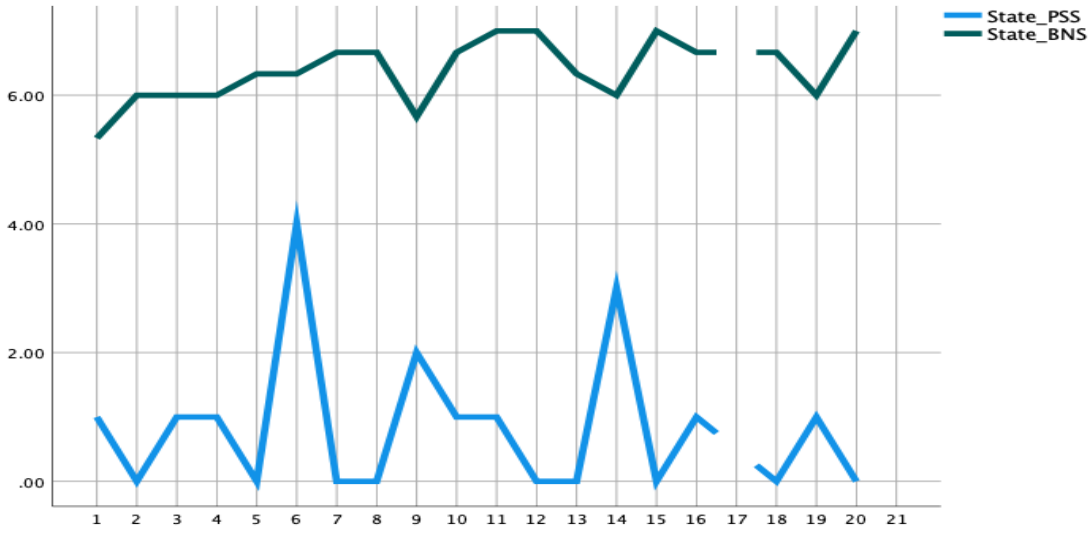

Figure 1: Participant scoring low on perceived stress and high on BNS

High state perceived stress, low state BNS. Another participant scored low on trait BNS (68) and high on trait stress (40). The subject also scored low on the trait BNS subscales autonomy (31), competence (14) and relatedness (23). Furthermore, the individual portraits strong fluctuations in perceived state stress over the time of measurement, reaching from four to ten. Looking at the plotted graph (Figure 2) one can see that the participant scored constantly relatively low on state Basic Need Satisfaction (min: .67; max: 2.67) as well as considerably high on state stress (min: 4; max: 10). In this case, one cannot find a negative

association between the two variables, only during a few timepoints (10-11, 12-13, 13-14, 14-15, 19-20) a weak negative association could be assumed.

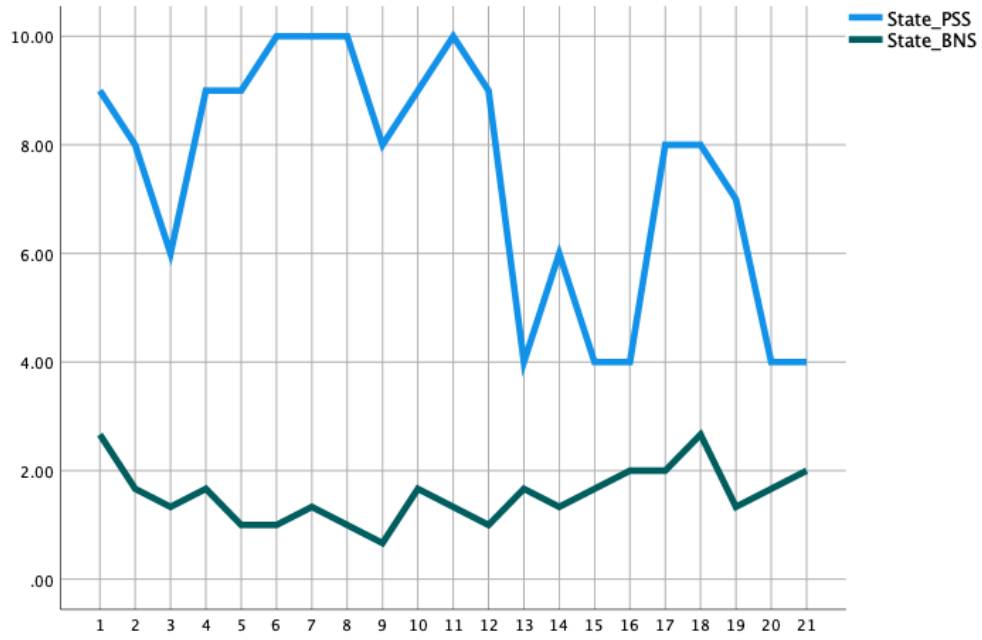

Figure 2: Example for high perceived state stress and low state BNS

Medium BNS, medium perceived Stress. Another participant scored medium on trait stress (23) and medium on trait BNS (115). Additionally, he/she scored medium on autonomy (33), competence (38) and relatedness (44). Again, looking at the graph (Figure 3) one can see that the subject scored average on the state BNS (min: 4; max: 5.67) and state perceived stress (min: 1; max: 9) measurements. A negative association is not easily visible in this graph, even though one might be able to see that at some timepoints (3-4, 9-10, 10-11, 12-13, 16-18) perceived stress and BNS change in a negatively associated manner.

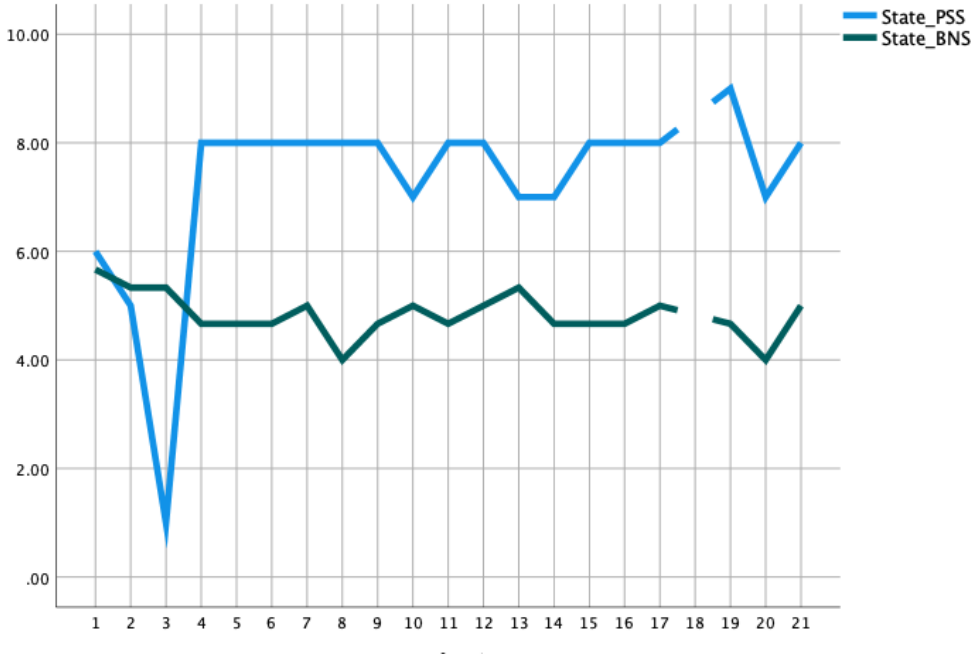

Figure 3: Individual scoring average on both perceived state stress and state basic need satisfaction

Perceived state Stress and BNS-subscales

When examining all participants individually it can also be of interest to look at the subscales of BNS. The frequency of simultaneous changes in competence, autonomy and/or relatedness values was examined to get a better understanding of a possible association between the subscales and perceived state stress. Every simultaneous change in perceived stress and any BNS-subscale was noted. It was found that competence changes 59.35 % of the time that it fluctuates together with perceived stress in a negatively associated manner. Furthermore, autonomy fluctuated 63.46 % of the time negatively compared to perceived stress. Also, the combination of the two subscales autonomy and competence acted similarly. To be exact, 84.91 % of the time that they both changed together with perceived stress, they fluctuated negatively in comparison to perceived stress. At last, the subscale relatedness did

not show a strong indication for an association, it increased 48.14 % of the time negatively compared to perceived stress.

Reliability

To evaluate the reliability of the state scales used, two separate split-half reliabilities were calculated for the state scales. The results of the split-half reliability indicated a significant and high reliability for the state BNS scale ($r = .991$, $p < .001$). Similar results were found for the stress numerical rating scale-11, also showing a significant and high reliability ($r = .978$, $p < .001$).

Discussion

The goal of this study was to investigate the relationship between perceived stress and basic need satisfaction in the everyday life of university students. Specifically, it aimed at answering the following research questions: (1) “How do daily changes in basic need satisfaction affect perceived stress in university students in daily life? “; (2) “How well does Basic Need Satisfaction predict perceived stress in the daily life of university students? “.

Concerning the first research question, the results indicate a predicting role of BNS on perceived daily stress. To be exact, the findings indicated a possible correlation between BNS and perceived stress. It seems that fluctuations of state BNS are often accompanied by negatively associated fluctuations in perceived state stress. For the second research question, similar associations were found. Specifically, the obtained findings indicate a predicting role of state BNS for perceived state stress. This study investigated a possible relationship that has not been extensively researched and hence helps to lay an important foundation for future researchers to further investigate in which way stress and Basic Need Satisfaction affect each other. Furthermore, the created state BNS scale (see Appendix E) showed high reliability, providing a helpful starting point for future researchers that want to investigate BNS using ESM.

Similarity of Results

Overall, the findings of this study seem to be mostly in line with existing literature. For example, the finding that autonomy is predicted by perceived stress in the everyday life of high-school students seems to be somewhat in line with one study that investigated the influence of BNS and stress on sleep in university students during exam-period (Campbell, Soenens, Beyers, & Vansteenkiste, 2018). The study found that increased levels of academic stress are associated with lower levels of the need for autonomy (Campbell, Soenens, Beyers, & Vansteenkiste, 2018). This could indicate that at least the finding that perceived stress predicts autonomy might be representative of the true association of autonomy and perceived stress. Additionally, Campbell, Soenens, Beyers and Vansteenkiste (2018) found that after the exam period, when stress decreases, students showed an increase in Basic Need Satisfaction. This again is in line with what this study found, namely that BNS is predicted by perceived stress in university students. Furthermore, Neufeld et al. (2020) found a negative correlation between Basic Need Satisfaction and perceived stress. This correlation did not correspond with the correlation the present study found in its strength, but the direction of the association appears to be in line with this study. This identified difference might result from the predictive power of BNS possibly being more pronounced in medical students or in general in the Canadian population. Additionally, the study of Neufeld et al. (2020) was conducted through the means of one online survey and thus carried out on a trait level.

Interpretation of Results

Nonetheless, the findings of this study must be viewed in the context in which they were obtained. Furthermore, due to the very nature of self-report measures, the presented results must be viewed critically and should not be seen as the absolute truth. Likewise, the analysis of individual graphs was conducted in an exploratory fashion, hence the obtained results must be viewed and interpreted with caution.

The found associations between state stress and state BNS offer support for the assumption that state BNS predicts perceived state stress in students. Moreover, the negative correlations indicate that individuals with lower BNS experience higher levels of stress in their daily life. Specifically, the correlations are very weak, which is not much in line with the expectations. Nonetheless, the strength of these associations might be a result of an inadequate sample, or of missing to adapt trait BNS items for the trait use. Since convenience sampling was used to gather participants, the correlations do not apply to the general population without replicating these findings in different contexts.

Furthermore, the results of the analysis of individual graphs suggest a similar relationship between autonomy and perceived stress on a state level, as well as competence and autonomy and perceived stress. This indicates that while relatedness might not contribute very much to the experience of stress in university students, the two needs of competence and autonomy predict the majority of stress. Underlying this assumption is also the obtain correlation coefficient for the subscale relatedness, with the weakest found correlation. This suggests that for university students, even though the need for relatedness is important in predicting perceived stress, autonomy and competence seem to possess a higher predictive power for state stress. It has been suggested that a high academic workload, as well as a lack of resources, might increase the perception of stress for students (Salanova et al., 2010). A high workload might relate to the need for autonomy since when one feels like there is too much to do it might lead to feeling like one does not have a choice in a task, thus low levels in the need for autonomy (Ryan & Deci, 2000; Weinstein & Ryan, 2011).

The results of this study have to be carefully viewed and at best only viewed in the context they are obtained in. All participants possess a relatively high educational background due to being university students, which hinders the generalizability of the results to the general population. There is also the possibility of other contextual issues that could

hinder the applicability of the present results to the whole population. One of these issues might be the missing adaptation of items of the BNSG-S to the state environment. Even though the reliability of the created scale seems to be quite high, the questionnaire has to be further validated in different populations to ensure a measuring instrument of high accuracy.

Implications

Despite these limitations, these findings suggest some practical implications. Firstly, as previously mentioned, this investigation of BNS and perceived stress in daily life can lay a foundation for future researchers to try and replicate the findings. Weinstein and Hodgins (2009) found that the satisfaction of the basic needs can be used as a defensive response that can help to regulate and most importantly maintain positive outcomes following negative events. This finding supports the idea that the satisfaction of the three basic needs is crucial for students to living and maintaining a life that is not dictated by the stress we experience in university and everyday life. Specifically, universities could use these insights to tailor some of their activities in a way that aims to maximise BNS in students. For instance, the relationship between supervisors and students often impacts the mental well-being of students, here universities could provide e.g., seminars that are aimed at providing supervisors with the skills and knowledge necessary to build and maintain need satisfying student-supervisor relationships (Hamann & Foster, 2014; Karasek & Theorell, 1990; Noblet & Rodwell, 2009). Supporting this notion is also Neufeld et al. (2020), stating the importance of facilitating the satisfaction of basic needs in medical students in increasing their well-being and decreasing their perceived stress. This underlines the need for universities to increase their support of the Basic Need Satisfaction as well as decrease the possibilities of frustrating students' needs, to foster student well-being and reduce stress.

Future researchers should more thoroughly investigate the relationships shown in this study. To be exact, as a starting point they could focus on the very weak negative association

between state Basic Need Satisfaction and state perceived stress. Additionally, future research could further investigate the individual associations between basic psychological needs and stress to try and replicate the findings of this study on a larger sample scale in different populations. Furthermore, in future research, the focus of investigation should be increased and include need frustration. Nonetheless, it served as a sufficient starting point for this study to focus solely on need satisfaction to further investigate the relationship between BPNT and perceived stress in the context of daily life. The inclusion of this additional concept might lead to a better understanding of the processes that influence state perceived stress. Supporting this recommendation is the presumption that need frustration can provoke distress (Vansteenkiste & Ryan, 2013

Conclusion

In conclusion, this study provides novel information about the relationship between BNS and perceived stress in daily life, an area that has not been intensely researched. Furthermore, this study lays an important foundation for future research on the state level of BNS. Likewise, the use of ESM opens a new field of BNS research which could provide some valuable insights on the state nature of BNS as well as the association to state stress. Additionally, could the results provide a good basis for the implementation of need satisfying activities and adaptations to feedback and teaching methods in universities. At last, it would be advised to replicate the findings of this study to establish a better generalization of the results as well as to rule out any potential contextual factors.

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Appendices:

Appendix A:

Basic Need Satisfaction in General Scale

1. I feel like I am free to decide for myself how to live my life.
2. I really like the people I interact with.
3. Often, I do not feel very competent. *
4. I feel pressured in my life. *
5. People I know tell me I am good at what I do.
6. I get along with people I come into contact with.
7. I pretty much keep to myself and don't have a lot of social contacts. *
8. I generally feel free to express my ideas and opinions.
9. I consider the people I regularly interact with to be my friends.
10. I have been able to learn interesting new skills recently.
11. In my daily life, I frequently have to do what I am told. *
12. People in my life care about me.
13. Most days I feel a sense of accomplishment from what I do.
14. People I interact with on a daily basis tend to take my feelings into consideration.
15. In my life I do not get much of a chance to show how capable I am. *
16. There are not many people that I am close to. *

17. I feel like I can pretty much be myself in my daily situations.
18. The people I interact with regularly do not seem to like me much. *
19. I often do not feel very capable. *
20. There is not much opportunity for me to decide for myself how to do things in my daily life. *
21. People are generally pretty friendly towards me.

* Items with reversed coding

Appendix B

Perceived Stress Scale (PSS)

1. In the last month, how often have you been upset because of something that happened unexpectedly?

2. In the last month, how often have you felt that you were unable to control the important things in your life?

3. In the last month, how often have you felt nervous and “stressed”?

4. In the last month, how often have you felt confident about your ability to handle your personal problems? *

5. In the last month, how often have you felt that things were going your way? *

6. In the last month, how often have you found that you could not cope with all the things that you had to do?

7. In the last month, how often have you been able to control irritations in your life? *

8. In the last month, how often have you felt that you were on top of things? *

9. In the last month, how often have you been angered because of things that were outside of your control?

10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

* Items with reverse coding

Appendix C

Stress Numerical Rating Scale-11

1. On a scale of 0 to 10, with 0 being no stress and 10 being worst stress possible, what number best describes your level of stress right now?

Appendix D

Informed Consent:

You are being invited to participate in a research study titled **"Let's find out more about your daily stress level."**.

The purpose of this research study is to find out more about the association between daily stress levels and emotion-focused coping, neuroticism and basic need satisfaction.

Participating in this study is completely voluntary and all your responses are treated anonymously and remain confidential. Data will only be used for statistical analyses. Furthermore, you can withdraw from the study at any time without any reason.

If you would like to have further information about the research, now or in the future, feel free to contact:

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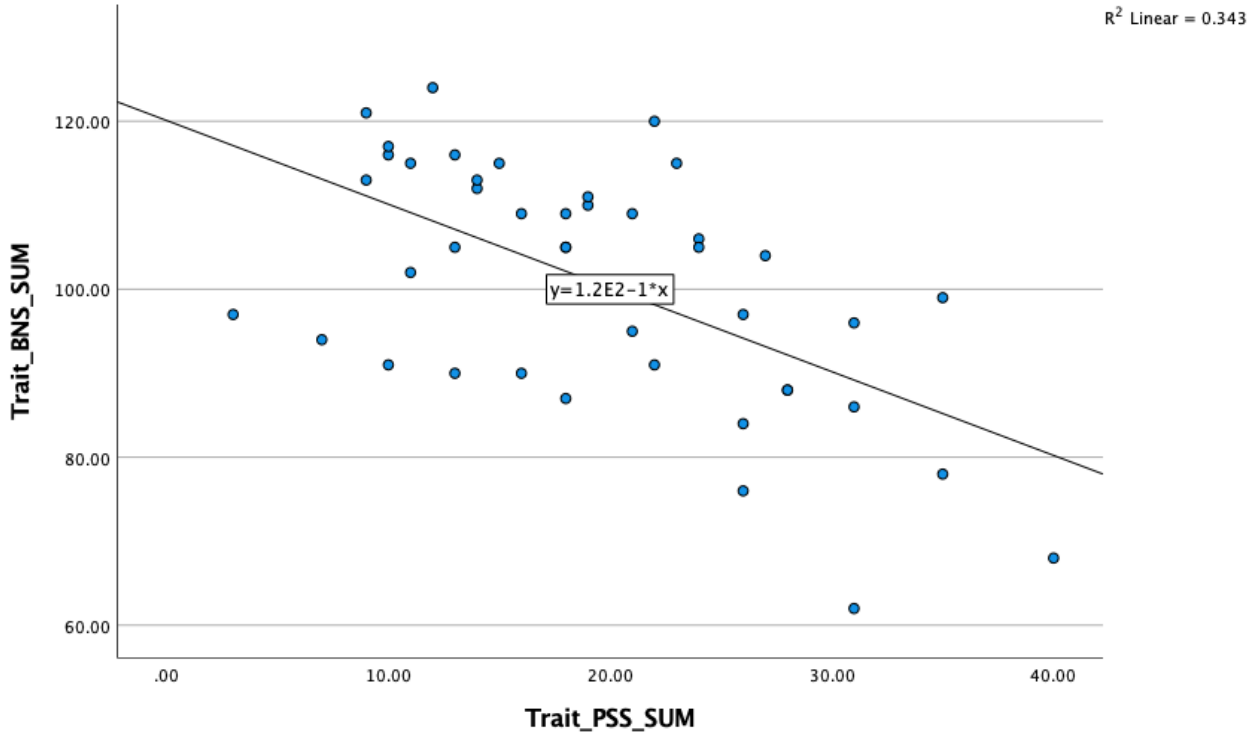
Appendix E

State Basic Need Satisfaction Items

1. I feel like I can pretty much be myself in my daily situations.
2. Most days I feel a sense of accomplishment from what I do.
3. People are generally pretty friendly towards me.

Appendix F



Appendix F: *Scatterplot with fitted regression line showing the relationship of trait BNS and trait stress*