

**Effects of Psychological Need Frustration on Revenge Bedtime Procrastination among  
College Students**

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### **Abstract**

Sleep-deprivation is associated with a number of negative outcomes, such as decreased positive affect and life purpose. It was previously shown that bedtime procrastination is a predictor for sleep-deprivation and decreased sleep quality. A form of bedtime procrastination is revenge bedtime procrastination (RBP), which assumes an intentional delay of sleep to engage in leisure activities which could not be pursued during the daytime. To test whether RBP is predicted by the frustration of one's basic psychological needs (i.e., the need for autonomy, relatedness, competence), a convenience sample of 102 college students was recruited. Self-determination theory assumes that not satisfying one's basic psychological needs results in negative consequences, such as stress and poor sleep. Therefore, this study examined whether basic psychological need frustration and RBP engagement were positively correlated, and whether perceived academic distress (PAS) mediated this relationship. The results showed that although need frustration and RBP engagement were positively related, PAS mediated the relation between need frustration and RBP engagement. These findings highlight that fulfilling one's psychological needs and reducing stress could be steps to reduce RBP and consequently sleep deprivation.

*Keywords:* Revenge bedtime procrastination, self-determination theory, basic psychological needs, perceived academic stress, college students

## **Effects of Psychological Need Frustration on Revenge Bedtime Procrastination among College Students**

Getting a refreshing, good night of sleep is essential for daily functioning (Galland et al., 2010). Especially in young adolescents, sleep plays a crucial role in one's overall physical and mental health (Owens & Weiss, 2017; Chaput et al., 2016). However, college students commonly engage in bedtime procrastination (Chen, 2019; Cui et al., 2021; Ma et al., 2020; You et al., 2021; Zhang & Wu, 2020) which is a known predictor for sleep-deprivation and was found to be widely spread in the overall population (Kroese et al., 2014; Kroese et al., 2016). Sleep deprivation in turn was found to be associated with obesity, type 2 diabetes, and hypertension (e.g., Buxton & Marcelli, 2010; Gangwisch et al., 2006; Sabanayagam & Shankar, 2010). Moreover, a strong association between sleep deprivation and poor work efficiency, as well as poor academic performance was found (Wolfson & Carskadon, 2003; Curcio et al., 2006; Ming et al., 2011). Additionally, there is an association between sleep deprivation and emotional instability, decision making, decreased positive affect, and purpose in life (Gohar et al., 2009; Haack & Mullington, 2005; Harrison & Horne, 2000; Ram et al., 2010; Steptoe et al., 2008; Stickgold, 2001).

Given the fact that not much is known about the reasons why people engage in bedtime procrastination, it is of high importance to fill this research gap to find ways to target interventions for people who are sleep-deprived because of bedtime procrastination. This study focuses on a specific form of bedtime procrastination, namely: revenge bedtime procrastination (RBP), which is about intentionally delaying one's bedtime to engage in leisure activities while being aware of the negative consequences (Liang, 2020). One possible explanation of RBP could be since bedtime procrastinators are not able to fulfill their psychological needs (Ryan & Deci, 2000) during the daytime and thus seek compensation and relief of this need frustration in the late-night hours (Liang, 2020).

The following study is based on the research questions of whether RBP arises from not meeting one's psychological needs during the daytime and whether perceived academic stress (PAS) is mediating this relationship. In this research, I draw on self-determination theory by Ryan and Deci (2002) to explain how need frustration can affect college students' engagement in RBP. This is because fulfilling one's psychological needs has previously been shown to be related to sleep outcomes (e.g., Campbell et al., 2015, 2018, 2019). Furthermore, I will refer to PAS and how it affects the relation between need frustration and RBP. The study could potentially give further support to self-determination theory and the importance of fulfilling one's psychological needs during the day to reduce RBP. This in turn might foster interventions to increase the satisfaction of the basic psychological needs and reduce academic stress in students.

### **Revenge Bedtime Procrastination**

Kroese et al. (2014) introduced the concept of bedtime procrastination (BP) within the research area of health. The concept of BP is defined as "going to bed later than intended while no external circumstances are accountable for doing so." (Kroese et al., 2014), and as "needlessly and voluntarily delaying going to bed, despite foreseeably being worse off as a result" (Kroese et al., 2016). In this study, the focus is on RBP, which is a form of BP. RBP focuses on intentionally sacrificing sleep for leisure time (Liang, 2020). This form of revenge is motivated by the idea that people do not have enough personal time during the day and thus try to compensate for their need for some "me-time" in the late hours and therefore delay sleep (Liang, 2020). In a BBC article, Gu Bing says that "Even though I am tired the next day, I don't want to sleep early," and "I really need that time. I want to be healthy but they [her employers] stole my time. I want to steal back my time." (Liang, 2020). Heejung Chung, points out that "You need that time to unwind. Workers need something to do other than work. It's risky behaviour to do only one thing." Thereby, the intentional delay of sleep is motivated by leisure time engagement which often cannot be done when people are faced

with stressful days (Liang, 2020). When comparing BP and RBP there is some overlap. Nauts et al. (2019) studied the different explanations people gave for engaging in BP. They found three prevalent themes: deliberate procrastination, mindless procrastination, and strategic delay. Deliberate procrastination means that someone is knowingly and intentionally delaying bedtime (Nauts et al., 2019). Mindless procrastination means that one has diminished awareness of procrastinating, by losing track of time (Nauts et al., 2019). Finally, people could delay their intended bedtime because of a strategic delay which points out the fear of not being able to fall asleep and thus prolonging wakefulness to become more tired later (Nauts et al., 2019). However, the following study will only focus on the deliberate intention of delaying bedtime and the revenge part of delaying one's sleep.

With respect to what is known on why people engage in BP, Kroese et al. (2014), recruited a community sample and examined in an online survey the relation between BP and self-regulation and whether BP predicted insufficient sleep. They could find evidence that people who had low self-regulation engaged in more BP. Thereby, low self-regulation is associated with short-term gratification and a neglect in activities that are goal-relevant (Tangney et al., 2018). Additionally, they found that there was a relationship between BP and subjectively-reported insufficient sleep (Kroese et al., 2014). With respect to consequences of engaging in BP, Exelmans et al. (2019) investigated how delaying bedtime by watching TV, as a procrastinatory behavior, affected subjective sleep quality. There was a significant relation between tv watching and poorer sleep quality (Exelmans et al., 2019). Regarding interventions it was found in a sample of young adults that engaging in mindfulness predicted lower levels of BP and in turn better sleep quality (Teoh & Wong, 2022).

So far little is known about the reasons why people engage in RBP. One possible explanation could be due to the fact that intentional bedtime procrastinators are not able to fulfill their psychological needs (Ryan & Deci, 2000) during the daytime and thus seek compensation and relief of this need frustration in the late-night hours (Liang, 2020).

## **Self-determination Theory and RBP**

According to self-determination theory, people have the innate motivation for the satisfaction of the three psychological needs, which are autonomy, relatedness, and competence (Ryan & Deci, 2000). Moreover, the fulfillment of the basic psychological needs was found to be essential for effective functioning and mental health (Ryan & Deci, 2000). Thereby autonomy refers to someone's willpower and having a sense of self-endorsement over the task one is engaging in (Ryan & Deci, 2006). The competence need refers to the belief that one has the ability to acquire and improve new skills (Ryan & Deci, 2002). Finally, the need for relatedness refers to feeling safe with and connected to other people in one's environment (Ryan & Deci, 2002).

The satisfaction of the basic psychological needs can predict a person's intrinsic motivation, which is the motivation to engage in a task because of enjoyment or interest in that activity (Ryan & Deci, 2002). When a person feels intrinsically motivated to perform a certain task, meaning of life and overall well-being increase (Ryan & Deci, 2002, 2018). Looking at psychological need satisfaction in the academic context, it was found that when teachers are autonomy supportive, which means they provide students with choices and encouragement to increase the confidence in their abilities, students experienced a satisfaction of their psychological needs (e.g., Jang et al., 2012). More specifically, autonomy support predicted students' optimal engagement and intrinsic motivation towards their education (Jang et al., 2009).

Need frustration entails that one's psychological needs are actively undermined, in particular by other people (Grolnick 2003; Chen et al. 2015; Deci & Ryan, 2000). Need frustration was found to be related with psychological maladjustment and can even lead to psychopathology, such as burnout (Li et al., 2013; Vansteenkiste and Ryan, 2013). Moreover, need frustration predicted student's disengagement in school (Adigun et al., 2022). Student disengagement was found to be prevalent to have various negative consequences,

such as poor academic performance, feeling discouraged, and being more likely to be absent from school (Calderon & Yu, 2017). Importantly, it was also found that when psychological needs are frustrated for a longer amount of time, people engage in coping strategies, need substitutes and compensatory behaviors which are often times maladaptive for daily functioning (Deci & Ryan, 2000; Ryan et al., 2006). Thereby, need substitutes are tasks that have a compensatory function to make up for the frustrated needs (Deci & Ryan, 2000; Ryan et al., 1996). Instead of engaging in intrinsic goals, people may try to pursue extrinsic goals, such as popularity in order to seek for external validation, when intrinsic worth cannot be found (Deci & Ryan, 2000; Ryan et al., 1996).

Since there is no research of need frustration and RBP, I reviewed literature which focused on the relation between lack of psychological need fulfillment/need frustration and sleep. Niemiec et al. (2022) could find support for the association between lack of psychological need fulfillment and sleep disturbances in health-care workers. They investigated employees for a 15-month period and found that health-care workers are more likely to experience anxiety, depressive symptoms and sleep problems when the basic psychological needs of autonomy, competence and relatedness were not met in the workplace (Niemiec et al., 2022). Campbell et al. (2018) found similar results by investigating university student's sleep during exam period. University student's psychological need satisfaction was assessed before, during and after exams. They found with elevated stress and need frustration, sleep quality decreased (Campbell et al., 2018).

Based on previous studies that are built on SDT and highlight the detrimental effects of need frustration, in this study it will be investigated whether need frustration in students affects the frequency of engaging in RBP. It is hypothesized that the frustration of the basic psychological needs of autonomy, relatedness and competence is positively correlated with RBP engagement, as a way to recharge one's resources (one's psychological needs) to function for the next day and to compensate for the need frustration that was experienced

during the day. For instance, could students who engage in RBP socialize at night to compensate for the frustration of relatedness, or people who have not felt autonomous regarding their decisions in their studies, could engage in a hobby that gives them the self-endorsement they were missing. Thus, RBP is assumed to have a compensation function by engaging in pleasant activities that could not be carried out during the day because of (academic) responsibilities.

**Hypothesis 1.** The frustration of the basic psychological needs is positively related to RBP engagement.

### **Need Frustration, Stress, and RBP**

Weinstein and Ryan (2011) found that the frustration of one's psychological needs is related to the experience of stress and poor sleep, in adults (Weinstein & Ryan, 2011). Consequently, it is questionable whether stress could also mediate the relation between need frustration and RBP engagement in college students. Hence, in this study, another focus is the mediating role of perceived academic stress (PAS) in the relation between need frustration and RBP, in college students. People experience perceived stress when they cannot cope with stressors in an adaptive way because their coping resources are depleted (Cohen et al., 1995). Bedewy and Gabriel (2015) found that educational influences made up a large part of the stress of students, while physical, social, and emotional factors were having less contribution to the stress experienced in students. Academic stress is particularly related to negatively affecting adolescents' mental health, such as depression (Zhang et al., 2020), and was found to contribute to poor academic performance (Sohail, 2013).

PAS as a mediator between the relation of need frustration and RBP could be interesting to examine because people might delay their bedtime because they may feel stressed because of the psychological need frustration they have experienced during the day (Weinstein & Ryan, 2011). More specifically, it was shown that people get aroused and feel tense due to stress (Lovibond & Lovibond, 2004) which may pose difficulties to relax at night



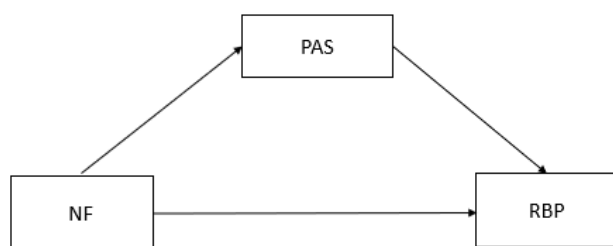
(Campbell et al., 2021). This was supported by a longitudinal study that showed that adolescents experienced poorer sleep quality and quantity in times of elevated levels of stress (Galambos et al., 2010). Furthermore, perceived stress was found to predict shorter sleep duration, which was based on self-reports of participants (Fuligni & Hardway, 2006). To get into a relaxed state, it can be assumed that stressed students might try to engage in activities, such as watching Netflix to unwind. This is because watching TV was found to be a way to relieve stress (Zillmann, 1982; Singer 1980). However, this may contribute to a delay in bedtime because this time for oneself requires some space that would have been ideally spent sleeping, to feel refreshed and functioning for the next day (Galland et al., 2010).

Campbell et al. (2021) already investigated in a diary study the relation between adolescent psychological needs and sleep by including stress as a mediator. They found an association between need frustration, decreased daily sleep quantity and subjective sleep quality (Campbell et al., 2021). This finding was also previously supported in other studies (Campbell et al., 2018). However, stress did not contribute to this relationship. Contrarily, previous studies did find the mediating role of stress in the association between need frustration and poor sleep in college students (Campbell et al., 2018). Moreover, the researchers found a reciprocal relationship between need frustration and sleeping pattern, as poor sleep also predicted a lack of need fulfillment because college students did not have enough energy to engage in activities that fostered need satisfaction (Campbell et al., 2021). However, as this study focused on subjective sleep quality and not on RBP, it would be interesting to investigate if the findings are also applicable to RBP as this concept is a predictor of sleep deprivation.

As the frustration of one's psychological needs is related to the experience of stress and poor sleep (Weinstein & Ryan, 2011), it is hypothesized that perceived academic stress (PAS) mediates the relation between psychological need frustration and RBP. Moreover, it is assumed that people engage in RBP to dull the negative emotions, evolving from academic

stress, and being triggered by need frustration. For instance, it is assumed that students try to distract themselves of academic stress by, for instance, watching TV, and therefore delaying their bedtime.

**Hypothesis 2.** The frustration of the psychological needs (NF) is indirectly related to an increased frequency of RBP through the mediating role of perceived academic stress (PAS).



**Fig. 1.** Research model

## Method

### Participants

A total of 323 participants took part in this study. After accounting for people who did not fill out the informed consent or did not finish to complete the survey, a sample of 102 participants was analyzed. The participants were all students from different countries, with ages ranging from 18-47 (mean= 23, standard deviation = 4.811) and with about 77.5 % females, and 22.5 % males. Regarding the country of residence within the sample, 67% were from the Netherlands, 13% from Germany, 7% from other countries and 4% from the UK. Moreover, around 60% of the study participants completed high school, about 24% completed their Bachelor's, 15% their Master's, and 1 % their doctoral degree. It was also noticeable that 44 % of the participants were psychology students, while the rest of the participants studied different kinds of study programs.

## **Research Design and Procedure**

Before the study was conducted, it was approved by the Ethics Committee from the department of psychology at the RUG. Participants were asked to fill out an online questionnaire about the concept of RBP, which took about 15-30 minutes to complete. Participants were recruited based on convenience sampling. First, participants were informed about the concept of RBP and had to give their consent to participate in the study. RBP was operationalized as the days per week spend on procrastinating one's bedtime, and NF as the independent variable. PAS was the mediator in the analysis.

## **Measures**

### ***Revenge Bedtime Procrastination***

After participants were informed about the concept of RBP, we asked them to answer questions about their bedtime and sleeping behavior. On a 7-point Likert scale, participants indicated how many times they engage in RBP in a week (from "never" to "always") answering the question: "How often do you engage in such kind of behavior?".

### ***Need Frustration***

Moreover, participants were introduced to the Balanced Measure of Psychological Needs (Sheldon & Hilpert, 2012), which measures need satisfaction and need frustration. As the hypotheses are concerned with need frustration, in particular, items related to need satisfaction were recoded. Participants were asked to state from 1-5 (from 1 strongly disagree to 5 strongly agree) how much they agreed with the statements measuring the need frustration for autonomy, relatedness, and competence. The scale by Sheldon and Hilpert (2012) was adapted to an academic context since the study was targeted toward students' RBP. The scale included 8 items per basic psychological need. Items for the subscale for need frustration of autonomy entailed items such as: "I feel forced to do many things I wouldn't choose to do." For the need frustration of relatedness, there were items, such as: "I have the impression that other students I spent time with dislike me.". Finally, need frustration for competence items,

were for instance: “I have serious doubts whether I can do things well academically.”. For the subscale of autonomy, there was respectable reliability ( $\alpha = 0.799$ ). For relatedness the reliability was also high ( $\alpha = .854$ ), as for the subscale of the need frustration of competence ( $\alpha = .894$ ). Overall, the reliability of the total need frustration scale was high ( $\alpha = 0.908$ ).

### ***Perceived Academic Stress***

Academic stress was assessed with the Perception of Academic Stress Scale (Bedewy et al., 2015). Thereby, participants received 17 statements about their perception on academic stress. The statements were presented in a 5-point-Likert-scale format (from 1 strongly disagree to 5 strongly agree). Participants had to rate questions, such as: “Competition with my peers for grades is quite intense.”. Subsequently, participants indicated on a scale from 1-5 whether their experience of academic stress has changed over the past six months (from 1 significant decrease to 5 significant increase). The reliability for the PAS scale was respectable ( $\alpha = 0.783$ ).

## Results

**Table 1**

Descriptive Statistics, and Correlations.

	M	SD	1	2	3	4
1. age	23.451	4.811				
2. NF Total	2.547	0.585	0.123			
3. PAS	2.676	0.572	0.030	0.667***		
4. RBP frequency	3.149	1.813	.212*	0.308**	0.403***	

Note: N = 102. NF = Need frustration. PAS = Perceived academic stress. RBP = Revenge bedtime procrastination.

\*p < .05. \*\* p < 0.01. \*\*\*p < .001.

**Table 2**

Coefficients and confidence intervals for Linear Regression, showing the relation between NF and RBP, controlling for gender.

Covariates	B	SE	t	p	95% CI
NF	0.940**	0.294	3.193	0.002	0.356 to 1.524
gender	0.598	0.409	1.460	0.147	-0.214 to 1.410

Note: N = 102. CI = confidence interval. NF = need frustration. PAS = perceived academic stress.

\*p < .05. \*\* p < 0.01. \*\*\*p < .001.

**Table 3**

Coefficients and confidence intervals for Linear Regression, showing the relation between NF and PAS, controlling for gender.

Covariates	B	SE	t	p	95% CI
NF	0.640***	0.071	9.068	< 0.001	0.500 to 0.780
gender	0.326**	0.097	3.352	0.001	0.133 to 0.518

Note: N = 102. CI = confidence interval. NF = need frustration. PAS = perceived academic stress.

\*p < .05. \*\* p < 0.01. \*\*\*p < .001.

**Table 4**

Coefficients and confidence intervals for linear regression, showing the mediation effect, controlling for gender.

Covariates	B	SE	t	p	95% CI
NF	0.306	0.398	0.769	0.444	-0.485 to 1.098
PAS	1.015*	0.422	2.406	0.018	0.177 to 1.852
gender	0.240	0.425	0.565	0.574	-0.603 to 1.083

Note: N = 102. CI = confidence interval. NF = need frustration. PAS = perceived academic stress.

\*p < .05. \*\* p < 0.01. \*\*\*p < .001.

### Statistical Analysis

This study aimed to examine the impact of need frustration on the frequency of engaging in RBP. It was hypothesized that basic need frustration would be positively related to RBP engagement. Secondly, it was hypothesized that the frustration of the basic psychological needs is indirectly related to RBP via the mediating role of PAS.

The statistical analysis was conducted using JASP (Version 0.14.0). First, I calculated the reliability of the scales. Then, I checked for outliers and calculated the descriptive statistics and correlations between the variables. Third, the mediation of PAS between NF and RBP was examined. To test whether PAS mediated the relationship between NF and RBP engagement, I followed the method by Baron and Kenny (1986). They propose that by running three linear regressions, it can be examined whether a mediation effect is present. First the relationship between need frustration and RBP frequency was examined. Next, the relationship between need frustration and PAS was tested. Finally, the relation between need frustration and RBP was investigated, while controlling for PAS. Gender was included as a control variable in the model.

### **Relation between NF and RBP**

To test the first hypothesis, namely that NF is positively correlated with RBP frequency, the correlation between these two constructs was calculated using JASP (Version 0.14.0). Table 1 shows the means, standard deviations, and correlations for all variables. The total need frustration (NF), which is the composite mean of the need frustration of autonomy, relatedness, and competence, showed a moderate and significant correlation of 0.308 with the frequency of engaging in RBP (Table 1).

### **Assumptions**

Before conducting the mediation analysis to test the first hypothesis, the assumptions for normality, linearity, homoscedasticity, and homogeneity of error variance were checked. For the total NF, the assumption for normality was met, which can be seen in fig. 3. Moreover, linearity and homoscedasticity were met, which can be seen in Fig. 4 showing the residuals vs. predicted plot. The homogeneity of error variance was met for NF in relation to RBP with the mediator PAS, which was tested with the Durbin-Watson test. For the predictor NF, in the mediation model, the value was  $DW = 1.8$  which is close to the desired value of  $DW = 2.00$ .

### **Mediation Model Analysis**

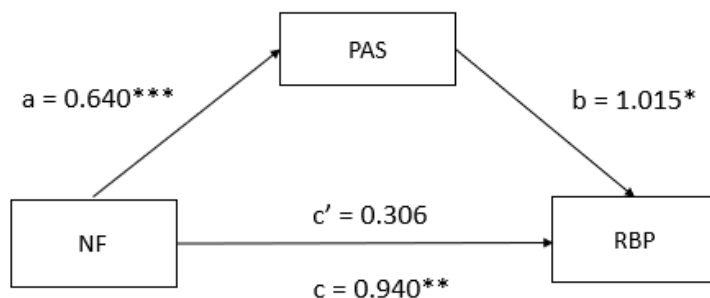
The linear regression coefficients and confidence intervals for the mediation analysis can be found in Tables 2, 3, and 4. To test hypothesis 2, namely whether PAS mediated the relation between NF and RBP, I first conducted a linear regression to test the relation between the independent variable, NF, and the dependent variable, RBP, while controlling for gender (Table 2). A significant relationship between NF and RBP could be found ( $b = 0.940$ ,  $t = 3.193$ ,  $p < 0.01$ ). Around 11 % of the variance was accounted for by NF ( $R^2 = 0.114$ ,  $df = 2$ ,  $F = 6.332$ ,  $p < 0.01$ ). Next, I tested the relation between NF and PAS, controlling for gender, which proved to be significant ( $b = 0.640$ ,  $t = 9.068$ ,  $p < 0.001$ ) and can be seen in table 3. The predictors accounted for around 50 % of the variance ( $R^2 = 0.503$ ,  $df = 2$ ,  $F =$

48.606,  $p < 0.001$ ). Here, gender also significantly predicted PAS ( $p < 0.01$ ). For the third linear regression, the mediation effect was tested (Table 4). Adding the mediator PAS to the model showed a significant mediation effect ( $b = 1.015$ ,  $t = 2.406$ ,  $p < 0.05$ ). PAS accounted for around 17 % of the variance in the model ( $R^2 = .169$ ,  $df = 3$ ,  $F = 6.367$ ,  $p < 0.001$ ). Importantly, it was shown that the relation between NF and RBP became insignificant once PAS was added to the model, showing that there is a mediation operating between total NF and RBP. The proportion of the indirect effect of PAS on the relationship between NF and RBP is 0.67 which is a medium to large effect size. The findings show that for the relation between NF and RBP, there is a mediation of PAS, since it was shown that as soon as PAS was added to the regression, NF no longer predicted RBP frequency.

### **Exploratory Analysis: Why do students engage in RBP?**

One of the major reasons, students engaged in RBP was due to the lack of time for themselves during the day because of daily obligations. Most explanations were based on the desire to spend some leisure time and take back control. For instance, “Usually, I don’t get time to myself until late (8 or 9 pm) and want to maximize this time. To this end I sacrifice sleep.”; “Because I have been stressed during the day with study and stuff, I have no time for myself to engage in entertainment or hobbies.”; and “watching Netflix.”. Others, also engaged in RBP to socialize by going out to parties, or by connecting with people on the phone. Additionally, students indicated to do some productive (school-related) work because they have procrastinated their work during the day or because they generally have a lot of work to do which has to be continued during the late-night hours. Fewer reasons for engaging in RBP were related to addictive behaviors, such as phone addiction and binge-watching series.





**Fig. 2.** Mediation model showing PAS mediating the relationship between need frustration and RBP. Note: \* $p < .05$ . \*\*  $p < 0.01$ . \*\*\* $p < .001$ .

## Discussion

The purpose of the study was to find predictors for RBP to give rise to future interventions for reducing RBP. This was done by investigating the relationship between NF and RBP engagement, as well as the role of PAS in mediating this relationship. In the compensation hypothesis, it was stated that people who do not fulfill their psychological needs for autonomy, relatedness, and competence, more frequently engage in RBP to compensate for the NF that was experienced during the day. The second hypothesis enclosed that PAS mediates the relationship between NF and RBP.

Overall, there was a moderate, positive, and significant correlation between NF and RBP, implicating that an increase in NF is related to an increase in RBP engagement. In addition, there was a significant mediation effect of PAS in the relation between NF and RBP. The direction of the relationship was positive, indicating that an increased NF of autonomy, relatedness, and competence was connected with an increased engagement of RBP. Gender did not play a confounding role in the relation between NF and RBP engagement and in the mediation model with PAS.

## Theoretical and Practical Implications

Following the results, there are a number of theoretical and practical implications. The study supports Ryan and Deci's self-determination theory. An increase in need frustration suggests an increase in RBP engagement, implicating that it is important to strive for

optimizing one's psychological needs to enhance mental well-being (Ryan & Deci, 2000). Besides, the notion that need frustration has detrimental outcomes such as stress and poor sleep (Weinstein & Ryan, 2011) is supported because the total need frustration is significantly correlated with PAS. Moreover, the mediation of PAS between NF and RBP engagement, is in line with the study by Campbell et al. (2018) who found that stress mediates the relationship between NF and sleep. However, the findings are contrary to Campbell et al. (2021), who found a direct relationship between need frustration and poor sleep, but no mediation of stress between these two constructs. As there is already some support for the mediating role of stress in the relation between need frustration and sleep, it can be assumed that the variable stress could be a predictor for RBP. Besides, it was found that students primarily engaged in RBP to enjoy some leisure time that they felt was lacking during the day. Other reasons also included connecting with people through socializing at parties or through social media (see exploratory analysis). This is in line with the first hypothesis as it is assumed that people who engage in RBP try to compensate for the need frustration during the day. For instance, it can be suggested that people compensate for the need for relatedness as they socialized with other people at night. However, based on the exploratory analysis it became not clear if these interactions were meaningful and yielded a sense of connectedness which is essential for the need fulfillment of relatedness (Ryan & Deci, 2002). The need for autonomy appeared to be regained for some students by engaging in activities they have control over, such as hobbies or other activities they engaged in out of enjoyment and not because of obligations (see exploratory analysis), which is in line with the concept of autonomous motivation which is the motivation to engage in a task because of intrinsic and internalized extrinsic motivation (Gagne & Deci, 2005; Ryan & Deci, 2000, 2002). The competence need seemed not to play a prominent role in RBP behavior. However, it could be assumed that people may try to fulfill their need of acquiring and developing a skill by engaging in hobbies they enjoy pursuing.

Therefore, the study's results give rise to practical implications for future research in the area of finding interventions to reduce RBP by focusing on psychological need fulfillment and stress reduction. It would seem advisable for chronic bedtime procrastinators to find ways to reduce their levels of stress during the daytime. As this study was targeted toward students and their perception of academic stress, it could be valuable to implement student integration programs at universities, especially for new students, to reduce the stress which comes from adapting to a new social and study environment. Concerning academic stress reduction, it was previously suggested to create a school environment where expectations for students, as well as individual strengths and weaknesses, are talked about to increase students' awareness (Burk & Bender, 2005). In addition, it was proposed to teach students to use emotion-focused and problem-focused coping strategies to deal with academic stressors (Iqbal et al., 2015).

Moreover, the findings implicate that interventions for reducing RBP should focus on satisfying basic psychological needs. For instance, students could try to increase their need for relatedness by joining a student association or by studying together with other students. For autonomy, it would be beneficial for students to regularly reflect on their desires and to check whether their current studies reflect what they want to do and what is expressing their identity to some extent. As previous studies have implicated the benefits of autonomy-supportive academic environments (Jang et al., 2009), it seems valuable to implement these strategies at universities. For instance, could it be helpful for students to write self-reflection reports to reflect on their study progress and whether they are still on track with their desirable professional future expectations. Regarding competence, it would be advisable for students to try to accomplish challenging aspects of their study on their own, so they get a feeling of control over their academic accomplishments. In addition, it could be helpful to engage in mindfulness to become more aware of need frustration and accept it in a non-judgmental way (Campbell et al., 2018).

To get a night of more refreshing sleep, it is also advisable for students to engage in sleep-hygiene behaviors, for instance by avoiding drinking coffee and by having a sleep schedule (Campbell et al., 2018).

### **Strengths, Limitations, and Future research**

Regarding strengths of our study, the inclusion of students with different nationalities contributes to the generalizability of our study.

There are multiple factors that contributed to this study's limitations. The sample size is a limitation of the study, since the number of students included in the study may not be representative for the population of students. Moreover, the participants constituted a convenience sample and thus results could be biased on respect to reasons for participating in the study. The focus was on western countries and on their individualistic culture (Markus et al., 1991), and a lack of collectivistic cultures can be found in the study, which contributes to an under-representation of the student population. One limitation of the online survey is that it was based on self-report measures. This could have given participants the room to engage in socially desirable responding (Paulhus, 1991) which could be the case for all the scales included in the survey since one might want to present oneself in a positive light. However, since the survey was anonymous, it is unlikely to be the case (Joinson, 1999). Because the study is based on a correlational design, no cause and effect could be established and confounding factors, other than gender, could have influenced the relationships between the variables. Thus, there was no experimental design present which would have contributed to more control of the study and more accurate conclusions.

For future research, it could be tested for bidirectionality of NF and RBP. More specifically, it could be examined whether increased RBP engagement is related to more need frustration in turn, as it is plausible that bedtime procrastinators might end up in a vicious cycle of delaying sleep and consequently frustrating their psychological needs in the daytime and vice versa. This is because the reciprocal relation between need frustration and poor sleep

was previously found (Campbell et al., 2021). In addition, it could be investigated in the future, whether other confounders could influence the relationship between NF and RBP. For instance, could it be tested whether chronotypes could be confounding this relationship since chronotypes were previously found to be explanatory for bedtime procrastination (Kadzikowska-Wrzosek 2018; Kühnel et al., 2018) and therefore might also be implicated in RBP. In future research it could also be examined whether low self-esteem could be a predictor for increased RBP engagement. This is because according to the sociometer theory of self-esteem people might experience a lower self-esteem when they are not valued and accepted by other people (Leary & Baumeister, 2000) and might have a frustration of the relatedness need. Based on this low-relatedness thus low self-esteem assumption, it could be tested whether low self-esteem can also predict RBP.

### **Conclusion**

Taking it all together, it was shown that the basic need frustration of autonomy, relatedness, and competence increases RBP engagement. Thereby, this association was explained through PAS as a mediator, highlighting the importance of satisfying the basic psychological needs and reducing academic stress. Consequently, this study adds some insights into the under-researched area of RBP. Despite the named limitations of the study, testable hypotheses were provided, which offers the opportunity for future research to replicate the study with a larger sample size in order to gain more confidence in the results.

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## Appendix A

### Measures

#### *BMPN scale*

1. I feel a sense of choice and freedom in the things I undertake
2. I feel that my decisions reflect what I really want
3. I feel my choices express who I really am
4. I feel I have been doing what really interests me
5. Most of the things I do feel like “I have to”
6. I feel forced to do many things I wouldn’t choose to do
7. I feel pressured to do too many things
8. My daily (study) activities feel like a chain of obligations
9. I feel that the people I care about also care about me
10. I feel connected with people who care for me, and for whom I care
11. I feel close and connected with other people who are important to me
12. I experience a warm feeling with the people I spend time with
13. I feel excluded from the group I want to belong to (in my university)
14. I feel that people who are important to me (other students) are cold and distant towards me
15. I have the impression that people (students) I spend time with dislike me
16. I feel the relationships (with other students) I have are just superficial
17. I feel confident that I can do things well
18. I feel capable at what I do
19. I feel competent to achieve my goals
20. I feel I can successfully complete difficult tasks
21. I have serious doubts about whether I can do things well (academically)
22. I feel disappointed with many of my (academic) performance
23. I feel insecure about my abilities (academic performance)
24. I feel like a failure because of the mistakes I make (at university)

*The Perception of Academic Stress Scale*

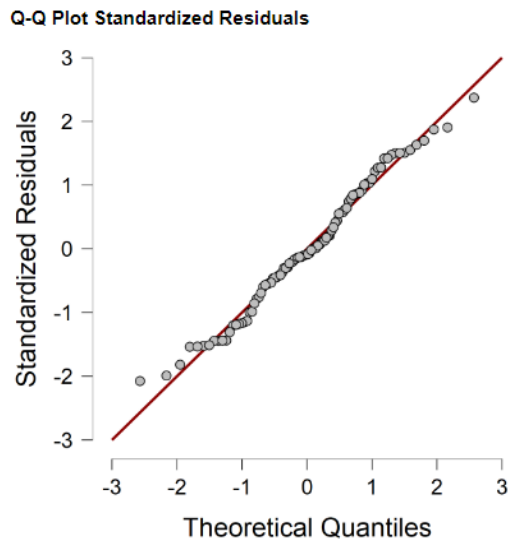
1. Competition with my peers for grades is quite intense.
2. My teachers are critical of my academic performance.
3. The unrealistic expectations of my parents stresses me out.
4. The time allocated to classes and academic work is enough
5. The size of the workload is excessive.
6. I believe that the amount of work assignment is too much.
7. I am unable to catch up if getting behind my work.
8. I have enough time to relax after work.
9. The examination questions are usually difficult.
10. Examination time is short to complete the answers.
11. Examination times are very stressful to me.
12. I am confident that I will be a successful student.
13. I am confident that I will be successful in my future career.
14. I can make academic decisions easily.
15. I fear failing courses this year.
16. I think that my worry about examinations is weakness of character.
17. Even when I pass my exams, I am worried about getting a job

## Appendix B

### Figures for Assumption Check

**Fig. 3.**

Q-Q Plot Standardized Residuals for autonomy, relatedness and competence.



**Fig. 4.**

Residuals vs. Predicted for need frustration.

