

Academic Procrastination in Undergraduate Students: Understanding the Role of Basic Psychological Need Satisfaction and Frustration and Academic Motivation

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Résumé de l'article

La procrastination est particulièrement répandue dans la population étudiante postsecondaire, avec des taux de prévalence allant de 70 à 95 %. Les étudiants citent systématiquement la motivation, ou le manque de motivation, comme l'une des principales sources de leur procrastination. L'une des théories les plus importantes expliquant la motivation est la théorie de l'autodétermination (TAD). Malgré les liens directs entre la motivation et la procrastination, cette dernière a rarement été examinée sous l'angle de la TAD. La présente étude examine la relation entre la satisfaction et l'insatisfaction des besoins psychologiques fondamentaux (BPF), et la motivation et la procrastination scolaires. Un échantillon de 617 étudiants de premier cycle a rempli un questionnaire en ligne portant sur leur expérience universitaire. Une analyse de médiation des données a été réalisée à l'aide de modèles d'équations structurelles. Les résultats indiquent que la motivation scolaire a un effet médiateur significatif sur la relation entre la satisfaction des BPF et la procrastination, mais pas sur la relation entre l'insatisfaction des BPF et la procrastination. Ces résultats démontrent l'importance de satisfaire les BPF des étudiants de premier cycle, car cela peut augmenter leur motivation scolaire et, par conséquent, réduire leur procrastination.



Academic Procrastination in Undergraduate Students: Understanding the Role of Basic Psychological Need Satisfaction and Frustration and Academic Motivation

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Abstract

Procrastination is particularly prevalent in the post-secondary student population, with prevalence rates ranging between 70–95%. Students have consistently cited motivation, or a lack thereof, as one of the main sources of their procrastination. One of the most prominent theories explaining motivation is self-determination theory (SDT). Despite the direct links between motivation and procrastination, procrastination has been scarcely examined through the lens of SDT. The current study examined the relationship between basic psychological need (BPN), satisfaction and frustration, academic motivation, and academic procrastination. A sample of 617 undergraduate students completed an online questionnaire about their university experience. Data were analyzed using mediational

structural equation models. Results suggested that academic motivation significantly mediated the relationship between BPN satisfaction and procrastination, but not the relationship between BPN frustration and procrastination. These results demonstrate the importance of satisfying the BPN of undergraduate students, as it may increase their academic motivation and, subsequently, reduce their procrastination.

Keywords: academic motivation, academic procrastination, self-determination theory, undergraduate mental health

Résumé

La procrastination est particulièrement répandue dans la population étudiante postsecondaire, avec des taux de prévalence allant de 70 à 95 %. Les étudiants citent systématiquement la motivation, ou le manque de motivation, comme l'une des principales sources de leur procrastination. L'une des théories les plus importantes expliquant la motivation est la théorie de l'autodétermination (TAD). Malgré les liens directs entre la motivation et la procrastination, cette dernière a rarement été examinée sous l'angle de la TAD. La présente étude examine la relation entre la satisfaction et l'insatisfaction des besoins psychologiques fondamentaux (BPF), et la motivation et la procrastination scolaires. Un échantillon de 617 étudiants de premier cycle a rempli un questionnaire en ligne portant sur leur expérience universitaire. Une analyse de médiation des données a été réalisée à l'aide de modèles d'équations structurelles. Les résultats indiquent que la motivation scolaire a un effet médiateur significatif sur la relation entre la satisfaction des BPF et la procrastination, mais pas sur la relation entre l'insatisfaction des BPF et la procrastination. Ces résultats démontrent l'importance de satisfaire les BPF des étudiants de premier cycle, car cela peut augmenter leur motivation scolaire et, par conséquent, réduire leur procrastination.

Mots-clés : motivation scolaire, procrastination scolaire, théorie de l'autodétermination, santé mentale des étudiants de premier cycle

Introduction

According to recent research, students have high prevalence rates of procrastination, ranging from 70–95% (Burka & Yuen, 2008; Schouwenburg et al., 2004). A considerable amount of recent research has focused on procrastination in the academic context. This is referred to as academic procrastination. Academic procrastination is restricted to the tasks and activities related to learning and studying (Steel & Klingsieck, 2016). Research has investigated the consequences, causes, and correlates of academic procrastination to inform the development and implementation of interventions for students.

Consequences of Procrastination

Procrastination is associated with negative academic and non-academic outcomes (Aremu et al., 2011; Grunschel et al., 2013; Hussain & Sultan, 2010; Kim & Seo, 2015). In terms of negative academic outcomes, procrastination is associated with extended periods of study, difficulty completing course work, absenteeism, and course withdrawal (Burka & Yuen, 2008; Schraw et al., 2007). Although many studies have suggested a negative association between procrastination and grade point average (GPA; Kim & Seo, 2015), other studies have failed to find evidence supporting this association (Schraw et al., 2007).

In terms of non-academic outcomes, procrastination is associated with both negative affective and health-related outcomes. Students often suffer from sleep-related problems (Grunschel et al., 2013), increased levels of stress (Williams et al., 2008), exhaustion, physical stress reactions (e.g., palpitations; Grunschel et al., 2013), and poor mental health (Stead et al., 2010). The affective outcomes of procrastination are equally debilitating and include feelings of guilt, decreased confidence, depression, anxiety, and low self-esteem (Steel & Klingsieck, 2016).

Motivation and Procrastination

The causes and correlates of procrastination are still poorly understood. Previous research has studied various factors (e.g., personality, situational characteristics); however, one of the most frequently studied relationships is between procrastination and motivation. Researchers have argued that the “mysterious character of procrastination vanishes when a motivational rather than volitional construal, such as self-regulatory failure, are conside-

red” (Grund & Fries, 2018, p. 1). The motivational perspective on procrastination views procrastination as a motivational problem rather than a trait- or skill-related one (Senecal et al., 1995). According to this perspective, those who have higher quality (i.e., autonomous) motivation are less likely to engage in procrastination than those with low quality (i.e., controlled) motivation (Mouratidis et al., 2017).

Self-Determination Theory (SDT) and Motivation

Motivational correlates have been explained by several different theories, with one of the most prominent being self-determination theory. SDT is a macro theory of human motivation and personality that has been used to explore and better understand students’ academic motivation (Ryan & Deci, 2000). SDT posits two different types of motivation—autonomous and controlled—that energize and drive behaviour. When an individual is autonomously motivated, they engage in activities because they are inherently enjoyable. On the other hand, controlled motivation comprises external regulation and introjected regulation, which reflect motivations produced by external contingencies (e.g., rewards) or external pressures (e.g., avoidance of shame).

According to SDT, there are three basic psychological needs (BPN)—autonomy, competence, and relatedness—necessary for developing more autonomous or self-determined forms of motivation. These needs are typically satisfied by an individual’s social environment (Ryan & Deci, 2000). Autonomy refers to feeling a sense of choice, willingness, and volition of one’s behaviour (Deci & Ryan, 1985). Competence refers to self-efficacy, or feeling effective in one’s actions or interactions with the environment. Competent individuals feel they can exercise their capacities in challenging situations (Deci & Ryan, 1985; Litalien et al., 2017). Relatedness refers to feeling connected to others and cared for by others. When the BPN are satisfied, individuals experience growth, integrity, and well-being (Ryan & Deci, 2000).

The importance of need satisfaction in both the psychological and emotional well-being of undergraduate students is well-established in previous research (Deci et al., 2001; Faye & Sharpe, 2008; León & Núñez, 2013). This research has shown that students who experience BPN satisfaction tend to have better academic outcomes due to better classroom adjustment, greater internalization of class material, and more autonomous forms of academic motivation (Kelly et al., 2008; Milyavskaya & Koestner, 2011). Auto-

nomous forms of motivation have been shown to mediate the relationship between BPN satisfaction and other well-being measures (Milyayskaya & Koestner, 2011; Weman-Josefsson et al., 2015).

When the satisfaction of the needs is actively blocked, BPN frustration may occur. The active blocking of BPN results in more negative outcomes than lower need satisfaction (Unanue et al., 2014). BPN frustration manifests in individuals who feel controlled by others (i.e., autonomy frustration), feel incompetent due to a lack of self-efficacy (i.e., competence frustration), or feel directly excluded by others (i.e., relatedness frustration). BPN frustration has been shown to result in more controlled motivations, or a lack of motivation entirely (i.e., amotivation; Oram et al., 2020). When BPN satisfaction and frustration were examined individually in a study by Krijgsman and colleagues (2017), results suggested an association between the frustration of needs, less self-determined motivation (i.e., amotivation), and increased fear in students. Although research examining BPN frustration in the academic domain is relatively scarce, the existing research has demonstrated that BPN frustration can influence students' perception of their school environment (Liu et al., 2017).

SDT, Motivation, and Procrastination

Relationships among autonomy support, BPN satisfaction, and academic motivation are well-established, as is the relationship between the different types of academic motivation and procrastination. Moreover, research has shown that autonomous motivation is a mediator between BPN satisfaction and other well-being outcomes. Despite these findings, few studies have examined BPN satisfaction, academic motivation, and procrastination. Cavusoglu and Karatas (2015) examined whether academic motivation mediated the relationship between BPN satisfaction and procrastination. Their results were consistent with previous literature (Cerino, 2014; Katz et al., 2014) and suggested that academic motivation is a predictor of procrastination. Furthermore, they found that the BPN were direct predictors of amotivation and intrinsic motivation, thus indicating an indirect relationship between BPN and procrastination. A more recent study by Codina et al. (2018) examined the relationships between controlling and autonomy-supportive teaching behaviours, need satisfaction, and procrastination. Their results suggested that need satisfaction was negatively associated with procrastination. However, this study did not examine the relationship between BPN satisfaction, motivation, procrastination, or BPN frustration and procrastination.

The Current Study

The previous studies did not examine the relationships among BPN satisfaction and frustration, autonomous and controlled motivation, amotivation, and procrastination in a general undergraduate population, despite interesting and novel findings. The current study aims to support and extend these previous studies by examining the relationships between all of the variables. We hypothesize that there will be significant positive relationships between BPN satisfaction and autonomous motivation and significant negative relationships between BPN satisfaction, controlled motivation, amotivation, and procrastination. We also hypothesize there will be significant negative relationships between BPN frustration and autonomous motivation and significant positive relationships among BPN frustration, controlled motivation, amotivation, and procrastination. Finally, we hypothesize that autonomous motivation, controlled motivation, and amotivation will be significant mediators in the relationships between BPN satisfaction and frustration and procrastination.

Method

Participants

Participants in the current study were undergraduate students ($N = 712$) from a large Canadian university (University of Ottawa). Students were recruited through advertisements on campus and a research participant pool where students receive course credit for participation in studies. Participants were removed if they completed less than 50% of the survey ($n = 68$) and if they completed the survey in less than 12 minutes ($n = 27$), as the survey was estimated to take approximately 12 to 15 minutes minimum. Of the remaining sample ($n = 617$), approximately 75% of participants were aged 18 to 20 ($n = 461$), and 20% were aged 21 to 25 ($n = 122$). The majority of participants were female ($n = 452$) and in their first year ($n = 367$). Participants identified as Caucasian ($n = 329$), Asian ($n = 104$), Arabic ($n = 52$), Black ($n = 47$), Indigenous ($n = 8$), or Hispanic ($n = 6$), while some indicated other ($n = 63$) or declined to answer ($n = 8$).

Measures

Basic Psychological Need Satisfaction and Frustration Scale. The Basic Psychological Need Satisfaction and Frustration Scale – work domain (BPNFS; Chen et al., 2015; Schultz et al., 2015) is a 24-item scale that assesses the levels of autonomy, competence, and relatedness satisfaction and frustration. Three subscales represent each participant's levels of needs satisfaction and frustration. The scale was adapted for the university context. Items are responded to on a 7-point Likert scale, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), with higher scores indicating higher need satisfaction or frustration. Internal consistency was sufficient among all subscales (Chen et al., 2015; Cordeiro et al., 2016; Schultz et al., 2015). In the current study, the satisfaction items and frustration items were randomly assigned to three parcels. The satisfaction parcels had a Cronbach's alpha of .89, and the frustration parcels had a Cronbach's alpha of .85.

Academic Motivation Scale. The Academic Motivation Scale (AMS; Vallerand et al., 1992) is a 28-item scale developed to measure the various dimensions of motivation in the post-secondary population. The scale is comprised of seven subscales that measure three types of intrinsic motivation (i.e., to know, toward accomplishment, and to experience stimulation), three types of extrinsic motivation (i.e., identified, introjected, and external regulation), and amotivation. Respective examples of items include, "*For the pleasure I experience while I am surpassing myself in one of my personal accomplishments,*" "*In order to obtain a more prestigious job later on,*" and "*I don't know; I can't understand what I am doing in school.*" Each of the subscales is comprised of four items, which are rated on a 7-point Likert scale, ranging from 1 (*does not correspond at all*) to 7 (*corresponds exactly*). Higher scores on subscales indicate a high endorsement of that specific type of academic motivation (Fairchild et al., 2005). Parcels were created from subscale items to reflect the constructs of autonomous and controlled motivation. In order to ensure that the latent constructs of autonomous motivation and controlled motivation were accurate, we conducted a principal components analysis. The eigen values, scree plot, and factor loadings suggested three-factor solutions with items corresponding to the appropriate latent construct. Items were randomly assigned to four parcels for autonomous motivation and four parcels for controlled motivation. Given that previous research has indicated that identified motivation reflects more autonomous extrinsic motivation, these items were included in the autonomous motivation parcels (Vallerand et al., 1993; Vansteenkiste et

al., 2004). Because the amotivation subscale consists of only four items, this construct was not parcelled. In the current study, the Cronbach's alpha across the autonomous motivation parcels was .92, .87 for controlled motivation, and .89 for amotivation.

Procrastination Assessment Scale for Students. The Procrastination Assessment Scale for Students (PASS; Solomon & Rothblum, 1984) is a two-part, 44-item self-report measure assessing students' procrastination. For our study, only part 1 was used. In part 1, there are 18-items for which students rate the extent to which they procrastinate in six academic areas (i.e., writing a term paper, studying for exams, keeping up with weekly reading assignments, academic administrative tasks, attendance tasks, and school activities in general). The first two items from the six sections of the PASS were used to create a mean procrastination score, as per scoring instructions from the authors (Solomon & Rothblum, 1984). The first items measure the frequency of procrastination (e.g., *To what degree do you procrastinate on writing a term paper?*), and the second items measure the degree to which procrastination on this task was a problem (e.g., *To what degree is procrastination on writing a term paper a problem for you?*). These were rated on a 5-point Likert scale. These items were randomly assigned to three parcels to create the latent procrastination variable. This variable had a Cronbach's alpha of .96.

Procedure

The University of Ottawa's Research Ethics Board provided ethical approval for the current study. Undergraduate students voluntarily participated in this study through an online research pool organized by the university. Participants were required to provide consent before they participated in the study. After consent was obtained, participants completed a brief online survey about their university experience. The participants were given two weeks to complete the survey. After two weeks, the survey was locked. Participants were compensated with one course credit or entered into a draw for a \$50 gift card within two weeks of study completion.

Results

Preliminary Analyses

Data screening. Of the total sample, only 0.8% of the data points were missing. Little's MCAR test results were non-significant (MCAR $\chi^2_{(24)} = 18.22, p = .79$), which indicated that the observed pattern of missing data was not significantly different from a completely random pattern of missing data. Given the low percentage of missing data and a non-significant Little's MCAR test, the expectation-maximization method was used for imputation (Carter, 2006).

Table 1

Means, Standard Deviations, Skewness, and Kurtosis

	<i>M</i>	<i>SD</i>	Skewness	Kurtosis
BPN Satisfaction	4.95	0.93	-0.14	-0.16
BPN Frustration	3.62	1.02	0.05	-0.09
Autonomous Motivation	4.83	1.02	-0.22	0.14
Controlled Motivation	5.37	1.05	-0.66	0.33
Amotivation	2.13	1.34	1.23	0.80
Procrastination	3.00	0.78	0.20	0.32

Note. BPN Satisfaction = Basic psychological need satisfaction; BPN Frustration = Basic psychological need frustration.

Means, standard deviations, and correlations. Means, standard deviations, skewness, and kurtosis of the observed variables are included in Table 1. Zero-order latent variable correlations are included in Table 2.

Table 2*Zero-Order Latent Variable Correlations*

	1.	2.	3.	4.	5.	6.
1. BPN Satisfaction	--	-.65**	.54**	.19**	-.46**	-.38**
2. BPN Frustration	--	--	-.30**	.06	.49**	.41**
3. Autonomous Motivation	--	--	--	.44**	-.35**	-.31**
4. Controlled Motivation	--	--	--	--	-.09**	-.08*
5. Amotivation	--	--	--	--	--	.29**
6. Procrastination	--	--	--	--	--	--

Note. BPN Satisfaction = Basic psychological need satisfaction; BPN Frustration = Basic psychological need frustration.

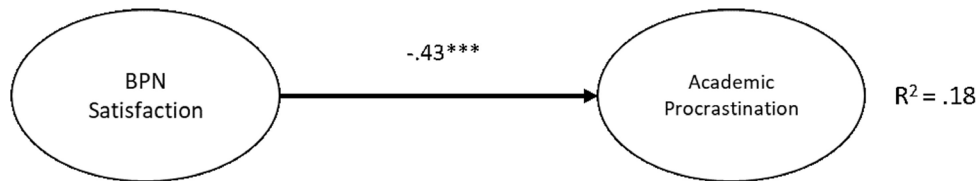
* $p < .05$

** $p < .001$

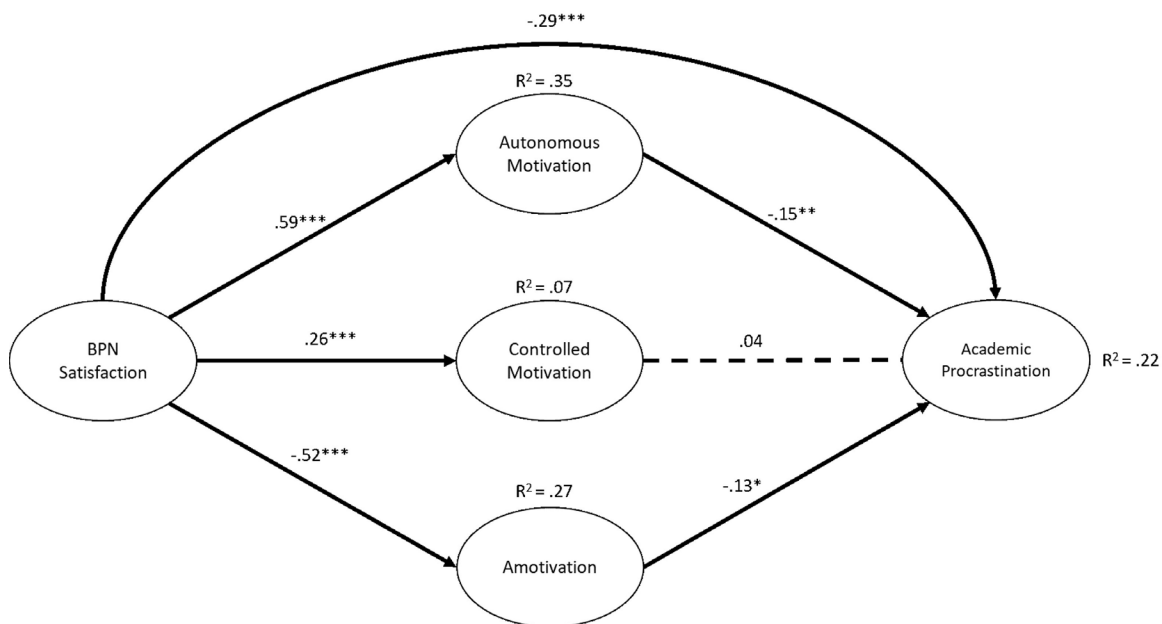
Structural Model

All models were tested using AMOS statistical software. Observed variables were used to create latent factors. Maximum likelihood estimation and bootstrapping were used for indirect and direct effects. The distributions of all variables were examined using skew and kurtosis statistics. All skew and kurtosis values were $<|2|$, and, thus, the distribution of the data was considered acceptable (Miles & Shevlin, 2001). Structural equation modelling (SEM) was employed, as it takes a confirmatory approach to the analysis of a structural theory (Byrne, 2001). In line with the recommendations of Byrne (2001), the fit of the models was evaluated using several goodness of fit indices, including the chi-square statistic (χ^2), Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA).

BPN satisfaction. BPN satisfaction was significantly and negatively associated with procrastination ($\beta = -.43, p \leq .001$) in the direct effects model. Figure 2 depicts the structural mediation model results with BPN satisfaction, autonomous motivation, controlled motivation, and amotivation, including their hypothesized paths and corresponding standardized estimates. The proposed model provided an acceptable fit: $\chi^2(197) = 4.01, p \leq .01$, CFI = .95, TLI = .94, RMSEA = .070, and SRMR = .85. All factor loadings of latent variables were within an acceptable range (Ertz et al., 2016).

Figure 1*Direct Effects Model with BPN Satisfaction*

Note: The direct effects model examining the relationship between BPN satisfaction and procrastination before adding the mediators to the model ($p < .001^{***}$).

Figure 2*Mediation Model with BPN Satisfaction*

Note: Structural mediation model. Solid lines represent statistically significant relationships ($p < .001^{***}$, $p < .01^{**}$, $p < .05^{*}$). Dotted lines indicate non-significant relationships.

This model showed that BPN satisfaction was significantly and positively associated with autonomous motivation ($\beta = .59$, $p \leq .001$) and controlled motivation ($\beta = .26$, $p \leq .001$), and negatively with amotivation ($\beta = -.52$, $p \leq .001$). Autonomous motivation was negatively associated with procrastination ($\beta = -.15$, $p \leq .01$), whereas amotivation

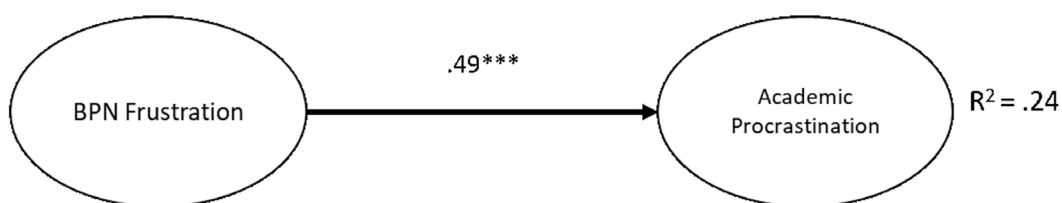
was positively associated with procrastination ($\beta = .13, p \leq .05$). Controlled motivation was not significantly associated with procrastination ($\beta = .04, p = .43$).

The standardized direct path from BPN satisfaction to procrastination was statistically significant after the mediators were included in the model ($\beta = -.29, p \leq .001$). The standardized indirect path of BPN satisfaction to procrastination was also statistically significant when considering all mediators ($\beta = -.40, p \leq .001$). This indicates that autonomous and controlled motivation and amotivation—altogether—play a significant role in the relationship between BPN satisfaction and procrastination. Sobel tests were conducted to examine the indirect effects individually. This revealed that autonomous motivation ($z = -2.62, p \leq .01$) and amotivation ($z = -2.34, p \leq .05$) were significant mediators in the relationship between BPN satisfaction and procrastination. In total, the variables in this path model accounted for 22% of the variance in procrastination.

BPN frustration. A model examining whether autonomous motivation, controlled motivation, and amotivation would mediate the relationship between BPN frustration and procrastination was also tested. First, a direct effects model was tested (Figure 3). BPN frustration significantly and positively predicted procrastination ($\beta = .49, p \leq .001$).

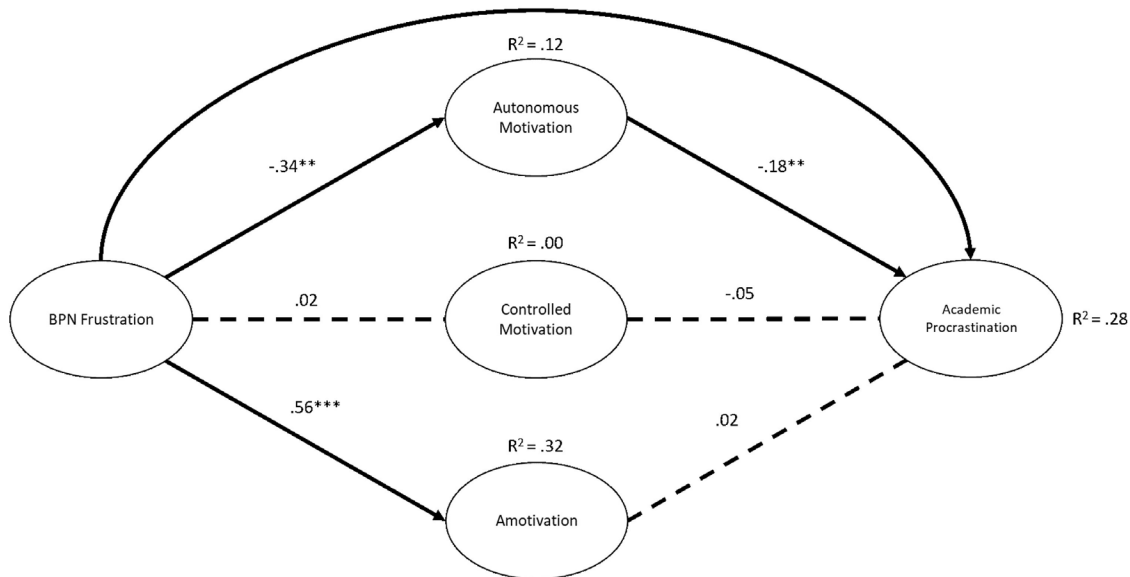
Figure 3

Direct Effects Model with BPN Frustration



Note: The direct effects model examining the relationship between BPN frustration and procrastination, before adding the mediators to the model ($p < .001***$).

Figure 4 depicts the structural mediation model results with BPN frustration, autonomous motivation, controlled motivation, and amotivation, including their hypothesized paths and corresponding standardized estimates. The proposed model was below the threshold of acceptable fit: $\chi^2(197) = 4.62, p \leq .01$, CFI = .93, TLI = .92, RMSEA = .078, and SRMR = .13. All factor loadings of latent variables were within an acceptable range (Ertz et al., 2016).

Figure 4*Mediation Model with BPN Frustration*

Note. Structural mediation model. Solid lines represent statistically significant relationships ($p < .001^{***}$, $p < .01^{**}$). Dotted lines indicate non-significant relationships.

This model showed that BPN frustration was significantly and negatively associated with autonomous motivation ($\beta = -.34$, $p \leq .01$) and positively associated with amotivation ($\beta = .56$, $p \leq .001$). BPN frustration was not significantly associated with controlled motivation ($\beta = .02$, $p = .63$). Autonomous motivation was negatively associated with procrastination ($\beta = -.18$, $p \leq .01$), whereas controlled motivation ($\beta = -.05$, $p = .27$) and amotivation ($\beta = .02$, $p = .69$) were not significantly associated with procrastination.

The standardized direct path from BPN frustration to procrastination was statistically significant after the mediators were included in the model ($\beta = .43$, $p = .01$). The standardized indirect path of BPN frustration to procrastination was marginally statistically significant ($\beta = .07$, $p = .51$), indicating that autonomous and controlled motivation, and amotivation—altogether—do not play a significant role in the relationship between BPN frustration and procrastination. A Sobel test was conducted to examine the indirect tests individually. This revealed that autonomous motivation was a significant mediator between BPN frustration and procrastination ($z = 3.45$, $p \leq .001$). In total, the variables in this path model accounted for 28% of the variance in procrastination. Due to the fit of this model, results must be interpreted cautiously.

Discussion

The current study's overarching goal was to support and extend previous research by examining the relationship between BPN satisfaction and frustration, academic motivation, and procrastination. The current study's results provided further evidence of significant relationships between BPN satisfaction and academic motivation, and academic motivation and procrastination. However, we did find novel results regarding the mediational role of academic motivation between BPN satisfaction and procrastination. Furthermore, the significance of relationships between BPN frustration, academic motivation, and procrastination is a new addition to both SDT and procrastination literature.

In the current study, BPN satisfaction significantly—either positively or negatively—predicted all three types of academic motivation. BPN satisfaction was positively associated with autonomous motivation, meaning that students who perceived their needs as satisfied were more likely to endorse autonomous motivations. The relationship between need satisfaction and autonomous motivation is a well-established finding in SDT research in various contexts (Frielink et al., 2018; Klaeijsen et al., 2018; Milyavaskaya & Koestener, 2011). BPN satisfaction was negatively associated with amotivation, meaning that students who perceived their needs as less satisfied were more likely to lack motivation entirely.

Contrary to previous studies that have found negative relationships between BPN satisfaction and controlled motivation (Frielink et al., 2018), our results suggested that need satisfaction positively predicted controlled motivation. This may be because autonomous and controlled forms of motivation are often simultaneously endorsed by approximately 50% of students (Ratelle et al., 2007). Nevertheless, our results support SDT's assertions that BPN satisfaction is an antecedent to high-quality motivation (e.g., autonomous motivation) and that low BPN satisfaction is related to amotivation (Krijgsman et al., 2017; Li et al., 2013; Milyayskaya & Koestner, 2011).

Our results also suggested that both autonomous motivation and amotivation significantly predicted procrastination in the context of BPN satisfaction. It is well-established in previous literature that academic motivation—when measured as a composite—is a significant predictor of procrastination (Burnam et al., 2014; Sirin, 2011). Furthermore, research has found that lower intrinsic motivation and amotivation are consistently related to higher procrastination in various educational contexts (Burnam et

al., 2014; Dunn, 2014; Klassen et al., 2008). In the current study, autonomous motivation was negatively associated with procrastination, whereas amotivation was positively associated with procrastination. Although we predicted that controlled motivation would be positively associated with procrastination, we did not find this association. However, some studies have found similar results where controlled motivation was not significantly associated with procrastination or, to a lesser extent, amotivation or autonomous motivation (Cerino, 2014).

Unlike BPN satisfaction, BPN frustration only significantly predicted autonomous academic motivation and amotivation. There was no significant relationship between controlled motivation and need frustration, despite being found in previous studies (Haerens et al., 2015). Moreover, autonomous motivation significantly and negatively predicted procrastination in the need frustration model. Need frustration is related to lessened self-control and may be associated with decreases in autonomous motivations and subsequent increases in procrastination behaviours (Vansteenkiste & Ryan, 2013). Neither amotivation nor controlled motivation significantly predicted procrastination in the context of BPN frustration. Theoretically, however, amotivation should predict procrastination and, thus, this result may be due to the variance being shared in this model among the variables.

Finally, our results suggested that BPN satisfaction and frustration are both direct and indirect predictors of procrastination. Although previous research has found that BPN satisfaction is significantly associated with procrastination (Cavusoglu & Karatas, 2015; Codina et al., 2018), this is the first study that has examined whether BPN frustration was associated with procrastination. When examining the direct effect of BPN, we found that satisfaction significantly and negatively predicted procrastination, meaning that students who perceived their needs as satisfied were less likely to engage in procrastination. Furthermore, we found that frustration significantly and positively predicted procrastination, meaning that students who perceived their needs as frustrated were more likely to engage in procrastination. By examining procrastination through the lens of SDT, we shifted the individual's focus to the learning environment created by the post-secondary institution.

Other SDT researchers have tested whether motivation is a mediator in the relationship between BPN and various outcomes, such as well-being and positive and negative affect (Katz et al., 2014; Malkoc & Mutlu, 2018; Milyavskaya & Koestner, 2011). However, our study is the first to examine whether academic motivation is a mediator in

the relationship between BPN satisfaction and frustration and procrastination. Like the results of the previous studies that examine motivation, we found that academic motivation partially mediated the relationship between BPN satisfaction and procrastination. This is likely due to multiple mechanisms by which BPN satisfaction can lead to or reduce procrastination. For example, BPN satisfaction may increase an individual's ability to self-regulate, which could increase their academic motivation and reduce their procrastination (Maryam & Mohtaram, 2019). Conversely, academic motivation was not a mediator in the relationship between BPN frustration and procrastination.

The strength of the relationship between BPN satisfaction and frustration and procrastination, compared to the relationship between academic motivation variables and procrastination, suggests that BPN satisfaction and frustration may contribute more significantly to procrastination. Rather than academic procrastination being a person-centred issue, it may be more related to the environment in which students find themselves procrastinating. According to our models, changing motivation may lead to procrastination if students experience a lack of need satisfaction or need frustration. Thus, it may be more critical for the university to focus on providing an autonomy-supportive environment.

Implications for Post-Secondary Institutions

As the number of individuals attending post-secondary institutions rises and students' demographic profiles diversify, post-secondary institutions face the increasingly difficult challenge of meeting the needs of all their students (Levesque-Bristol et al., 2019). Furthermore, student procrastination rates are staggeringly high across campuses, which can have significant negative impacts on their academic success (Kim & Seo, 2015). This study's results can have important implications for strategies used in interventions to target procrastination in the classroom and the post-secondary environment as a whole.

Given the prevalence of students citing procrastination as a significant problem in their academic lives, the implementation of procrastination interventions across post-secondary institutions may be a cost-effective approach. Despite the significant need, research concerning interventions remains scarce (Zacks & Hen, 2018). Recent intervention studies have typically employed various cognitive and behavioural strategies such as time management, acceptance and commitment therapy, and cognitive behavioural therapy to address procrastination. However, a recent meta-analysis study suggested that future

intervention studies should utilize self-determination theory, as BPN may be implicated in enhancing students' initiative (Van Eerde & Klingsieck, 2018). Our results showed a significant relationship between BPN satisfaction and procrastination, supporting the notion that targeting students' BPN in an intervention could potentially increase their autonomous motivation and, subsequently, decrease their procrastination.

Many post-secondary institutions are beginning to provide students with autonomy-supportive learning environments. Autonomy-supportive learning environments provide students with choices and options in the classroom and opportunities to demonstrate their skills regularly and interact with the professor in a meaningful and reciprocal way (Levesque-Bristol et al., 2019). Strategies for creating an autonomy-supportive learning environment include providing constructive, positive feedback, allowing students to choose their assignments' weighting, and being more approachable and relatable (Jang et al., 2016; Reeve, 2009). Purdue University has recently implemented the IMPACT program, a comprehensive multi-year campus-wide collaborative effort to achieve greater student-centred learning environments. It incorporates active and collaborative learning by fostering student engagement, competence, autonomy, and relatedness (Levesque-Bristol et al., 2019). The IMPACT initiative results have suggested the utility in supporting the BPN to increase student success and retention. The implementation of initiatives—such as IMPACT—across campuses internationally may allow for the targeting of procrastination on a large scale.

Limitations

Despite some novel results, there are several limitations associated with the results of this study. First, our models with BPN frustration did not have adequate fit, thus the results must be interpreted cautiously. Future studies should aim to re-test models with BPN frustration to obtain a model with adequate fit to ensure accurate results. Second, this study utilized a cross-sectional design due to limited time and resources. Future research should aim to measure these variables longitudinally. Longitudinal designs allow for more accurate causal interpretations of the results and a deeper understanding of the degree and direction of change over time among the variables (Caruana et al., 2015). Finally, this study did not measure or control for other variables that may play a role in the relationship between BPN satisfaction and frustration, academic motivation, and procrastination.

tion. Future research should aim to examine multiple mechanisms (e.g., students' perception of teaching style) and potentially compare models to determine which variables play the greatest role in this relationship.

Conclusion

This study was the first to examine the relationship between BPN satisfaction and frustration, academic motivation, and procrastination. Our results demonstrated the impact of BPN on both academic motivation and procrastination, and the moderate mediating role of academic motivation in these relationships. The results have important implications for how post-secondary institutions structure their courses and how professors interact with their students. We must adapt and ensure we provide students with an autonomy-supportive learning environment to address the complexity of student needs and increase their academic success.

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