



Test Anxiety in First-Generation Students: An Examination of the Role of Psychological Needs

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Abstract

It is estimated that 15-22% of students have high levels of test anxiety (von der Embse, Jester, Roy, & Post, 2018), which can be associated with greater academic stress and poorer educational performance (e.g., Steinmayr, Crede, McElvany, & Withwein, 2016). First-generation students (where neither parent has completed post-secondary education) are a critical group to study given that they are at higher risk for poorer educational attainment and being unsuccessful at the post-secondary level. Therefore, the purpose of this study was to examine the link between basic psychological needs and test anxiety in a sample of first-generation Ontario high school students across two points in time ($N = 147$; $Age = 14.82$, $SD = 1.28$). Self-report data was collected as a part of an on-going longitudinal study focusing on students attending a high school with specialized programming to enhance the transition to post-secondary institutions. Results from cross-lagged path analyses indicated that being older, female, and having higher levels of needs frustration significantly predicted higher levels of test anxiety over time within this sample. Our results highlight important educational implications, emphasizing the importance of fostering classroom environments where students perceive their psychological needs to be met, particularly within this unique population of students.



Introduction

Test anxiety constitutes a significant challenge to educational performance and plays a pivotal role in undermining academic achievement (Stankovska, Dimitrovski, Angelkoska, Ibraimi, & Uka, 2018; Steinmayr, Crede, McElvany, & Withwein, 2016; Zeidner, 1998). It is estimated that between 15-22% of students have high levels of test anxiety (Putwain & Daly, 2014; von der Embse, Jester, Roy & Post, 2018). Given the vast educational impacts that test anxiety has on students, it is critical to consider factors that may help provide insight into this complex phenomenon. Two factors central to Self-Determination Theory (Ryan & Deci, 2000) that may be particularly relevant with respect to understanding the nature of test anxiety are psychological need satisfaction and frustration. Indeed, research to date has shown that higher levels of test anxiety are associated with lack of need fulfillment among female high school students in Iran (Maralani, Shalba, & Lavasani, 2018). However, these relationships have not been tested over time or with first-generation students. It is well established that first-generation students (i.e., students who come from families where neither parent has graduated from postsecondary school) are a critical group to study given that they are at higher risk for poorer educational attainment, not applying to postsecondary education, and are four times more likely to leave postsecondary institutions without a degree (Finnie, Wismer & Mueller, 2015; Petty, 2014; Pratt, Harwood, Cavazos, & Ditzfeld, 2019; Radunzel, 2018; Smith & Gottheil, 2011; Stephens, Hamedani & Destin, 2014). From a preventative perspective, it is critical to study high school students where neither parent has completed post-secondary, as they have the potential to face additional challenges transitioning to and completing postsecondary education. Further, since test anxiety has been shown to be such a prevalent issue affecting key educational outcomes (von der Embse et al., 2018), it is important to continue to explore predictors of test anxiety, especially within high school students who may already be at risk for not going to post-secondary institutions. Thus, the goal of this study was to assess how psychological need satisfaction and frustration are related to test anxiety over time among first-generation students.

Test Anxiety

Test anxiety is a situation-specific form of trait anxiety that is defined as individual differences in assessing performance-evaluations (such as tests) as threatening (Spielberger & Vagg, 1995). In other words, students with high levels of test anxiety will tend to only respond with greater state anxiety to situations where performance will be evaluated (Putwain & Pescod, 2018). When students are disturbed by stress that is associated with taking tests, they may also experience more self-centred worry, and thoughts that are off task, which in turn, adversely affect their attention and performance (Spielberger, 2010). For example, a study by Owens, Stevenson, Hadwin, and Norgate (2014) found that higher levels of test anxiety has a negative impact on memory and attention, which is implicated in academic achievement, particularly when it comes to test-taking. Research examining nursing education students found that students reported that higher levels of test anxiety affected their ability to concentrate on tests, which negatively impacted their academic

performance (Khalaila, 2015). Further, in a sample of university students, Stankovska et al. (2018) found that there was a positive relationship between test anxiety and academic stress, which was also related to poorer academic performance.

Test anxiety is not only associated with poorer academic performance, but also with lower levels of self-esteem, and higher levels of defensiveness and other types of anxiety (Hembree, 1988). Steinmayr et al. (2016) examined test anxiety in a sample of adolescents and found that it was negatively associated with academic performance and overall subjective well-being. That is, test anxiety at baseline was not only associated with students' lower grade point average, but also negatively associated with life satisfaction and overall mood (Steinmayr et al., 2016). Further, a recent review by von der Embse et al. (2018) concluded that test anxiety is associated with poorer educational attainment (e.g., lower GPAs, lower standardized test scores, and poor performance on post-secondary entrance exams). Given the deleterious consequences of test anxiety it is critical to examine its antecedents, particularly in high risk groups of students. It is also important to consider theoretical frameworks that can help improve our understanding of potential antecedents of test anxiety in students. A particularly relevant theory for understanding test anxiety in students is Self-Determination Theory, as this theory is one of the most widely used frameworks with respect to key educational outcomes (Aelterman, Vansteenkiste, & Haerens, 2019; Beachboard, Beachboard, Li, & Adkison, 2011; Niemiec & Ryan, 2009).

Self-Determination Theory

Self-Determination Theory (Ryan & Deci, 2000) is one theoretical framework that holds significant promise for providing insight into the nature of test anxiety in students, offering psychological need satisfaction and frustration as potential pathways to test anxiety. According to this theory, all human beings have three innate needs that are necessary for healthy development and functioning: *autonomy* (freedom to make one's own choices), *competence* (belief in one's own efficacy), and *relatedness* (feeling that one is part of caring relationships). When these psychological needs are met, individuals are motivated to take action that is fully consistent with their own values and they experience greater well-being, including greater persistence and educational attainment (Bao & Lam, 2008; Hashemian & Soureshjani, 2011; Standage, Sebire, & Loney, 2008; Wei, Shaffer, Young, & Zakalik, 2005). However, when these needs are thwarted or frustrated, greater vulnerabilities for poorer performance, psychopathology, and defensiveness are engendered (Vansteenkiste & Ryan, 2013).

Within Self-Determination Theory is a mini-theory known as Basic Psychological Needs Theory (BPNT), which further argues that well-being is predicted by autonomy, relatedness and competence. BPNT suggests that contexts which either support or thwart these needs will impact wellness (Deci & Ryan, 1985). Therefore, psychological needs are measured via needs satisfaction and needs frustration. Relatedness satisfaction is characterized by an individual having a genuine connection with others. Competence satisfaction is characterized by feelings of being able to achieve individual goals. Autonomy satisfaction is the feeling a strong willingness when completing a task (Deci & Ryan, 1985). On the other hand, relatedness frustration is characterized

by experiencing loneliness, while competence frustration is characterized by having feelings of failure, and autonomy frustration is the feeling of being controlled by external or internal pressures (Deci & Ryan, 1985).

Importance of BPNT

Research to date has shown that psychological needs satisfaction and frustration are key contributors to overall well-being (e.g., self-esteem, life satisfaction) (Chen et al., 2015; Deci et al., 2001; Neufeld & Malin, 2019), along with school adjustment and academic engagement (Maralani, Lavasani & Gholamali, 2016; Ratelle & Duchesne, 2014). While few researchers to date have examined psychological needs in relation to test anxiety, research has demonstrated a link between general anxiety and mental health of individuals. For example, a study by Qusted et al. (2011) found that having higher levels of basic psychological needs satisfaction was related to lower intensity of anxiety and lower cortisol responses in a sample of competitive dancers. Further, researchers have found a link between basic psychological need satisfaction and academic outcomes. For example, academic well-being and school engagement as discussed by Niemiec and Ryan (2009) was found to be positively related to students' perceptions of psychological needs satisfaction. In a sample of Chinese students, Zhen et al. (2017) also found that basic psychological needs satisfaction was significantly associated with learning engagement. Psychological needs have also been found to be related to academic engagement, academic self-concept and overall grades (Gutiérrez, Sancho, Galiana, & Tomás, 2018). Taken together, these results demonstrate the importance of studying psychological needs satisfaction, due to the potentially negative outcomes that lack of satisfaction may have on individuals.

The Link Between Psychological Needs and Test Anxiety

Despite research indicating that psychological needs are significant contributors to a variety of key educational outcomes, there is a relative dearth of literature examining how psychological needs satisfaction and frustration contribute to test anxiety, which is surprising given that test anxiety is prevalent among youth. One exception is a study by Maralani, Lavasani and Gholamali (2016) that found a negative association between psychological needs and test anxiety in a sample of female Iranian high school students. These findings demonstrate that when individuals perceive that their needs are being met, their levels of test anxiety are lower. Further, another study examining a sample of female students in Iran, found that lack of need fulfillment was associated with higher levels of test anxiety (Maralani, Shalbah, & Lavasani, 2018) offering preliminary evidence for the assertion that the failure to satisfy psychological needs may be one avenue leading to test anxiety. Research to date on this link between psychological needs and test anxiety has been limited to restricted samples, and to our knowledge, these relationships have not been tested over time or specifically with first generation students. Further, given the current replicability crisis in psychology research (Anvari & Lakens, 2019), it is important that we not only attempt to replicate this link between basic psychological needs and test anxiety, but also extend this research to more

vulnerable samples such as high school students who will be the first in their family to attend post-secondary schools.

Why First-Generation Students?

Since first generation students (i.e., students who have parents that did not graduate from postsecondary education) are at risk for poorer educational attainment, and not attending or dropping out of post-secondary school; as a result, they are a particularly important group to study (Finnie, Wismer & Mueller, 2015; Petty, 2014; Pratt, Harwood, Cavazos, & Ditzfeld, 2019; Radunzel, 2018; Stephens, Hamedani, & Destin, 2014). Previous research examining first-generation college students has shown that compared to their non-first-generation counterparts, these students have lower academic engagement, and lower retention rates (Soria & Stebleton, 2012). Further, research has demonstrated that first-generation students are less likely to successfully complete four-year degrees in post-secondary institutions, even when taking into account other variables such as academic preparedness or their entrance testing scores (Warburton, Bugarin, & Nunez, 2001). These students are also more likely to experience difficulty with fitting in a University setting compared to continuing-generation students. This lack of social identification of first-generation students was found to be related to lower satisfaction with studying and increased levels of test anxiety within this sample (Janke, Rudert, Marksteiner, & Dickhasuer, 2017). Since test anxiety is a contributing factor to poorer educational outcomes, it becomes particularly important to study the contributors of test anxiety among this high-risk sample of students. Given that research highlights the potentially poor educational outcomes that first-generation students may be at risk for, our study examines high school students where neither parent has completed post-secondary education.

Current Study

Lack of need fulfillment appears to be associated with greater test anxiety in high school students (Maralani, Shalbaf, & Lavasani, 2018). However, to our knowledge, the association between psychological need satisfaction and test anxiety has not been tested within a sample of first-generation students or across time to establish temporal precedence. Therefore, the primary aim of this study was to employ a cross-lagged panel design to test a model in which psychological needs satisfaction and frustration were associated with test anxiety across two time points within a sample of first-generation students (see Figure 1). We hypothesized that lack of satisfaction along with greater frustration of psychological needs for autonomy, relatedness, and competence at baseline would predict higher levels of test anxiety at baseline (within time) and at time 2 after accounting for baseline levels of test anxiety (across time).

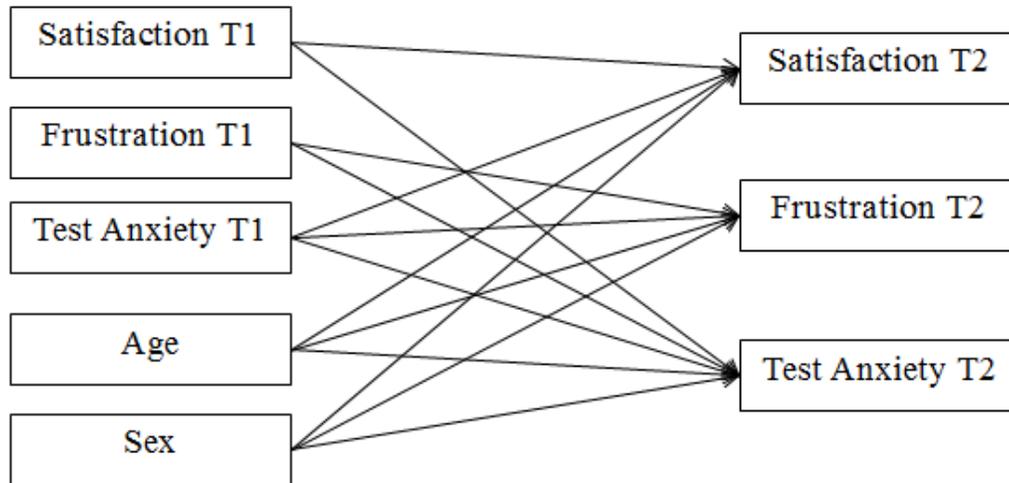


Figure 1. Hypothesized Cross-lagged Model of Psychological Needs at Time 1 Predicting Test Anxiety at Time 2. Note: Sex coded as 0 = Boy, 1 = Girl. Errors, terms and covariances are not shown for ease of presentation.

Methods

Participants

The data for the present study was a part of an on-going longitudinal study that will have several time points once carried out to completion. The present study focused on Times 1 and 2 as we do not yet have sufficient data for examining later time points. Data from this ongoing longitudinal study included 147 students (75 girls; 64 boys; 3 other; 5 did not report) between the ages of 13 and 18 years ($M = 14.82$, $SD = 1.28$) who completed both Time 1 and Time 2 of this study. Self-reported ethnicities were: 57.8% White; 6.1% Asian; 6.1% Black; 5.4% Indigenous Canadian; 7.5% Mixed; 7.5% Other, and 9.5% did not respond. Students in the present study were attending high school and were in the following grades at the time of entry: 47.6% in grade 9, 18.4% in grade 10, 11.6% in grade 11, and 21.1% in grade 12 (1.4% chose *Prefer Not to Say*). All students attended Starr Academy¹, an Ontario high school that has a special program for potential first-generation students that is geared towards helping them reach their post-secondary goals. This school draws on students from across an entire region (as opposed to being limited by physical boundaries of where the students live) and instead students can attend the school if they come from a family where neither parent has completed post-secondary education.

Procedure

Research assistants visited Starr Academy for data collection which was conducted during class time. All students completed self-report questionnaires online via Qualtrics using tablets, but data was only included for students who provided parental consent. All measures and procedures

¹ Starr Academy is a pseudo name to maintain confidentiality of participants.

were approved by both our University ethics board and the school board. Adolescents who gave both assent and parental consent to participate in the study and completed the questionnaires were compensated with a \$10 gift card. Questionnaires were completed every six months.

Measures

Demographics

Participants completed questions regarding their age, gender, ethnicity, socioeconomic status and educational goals.

Basic Psychological Need Satisfaction and Frustration Scale

Basic psychological need satisfactions and frustrations were assessed using the multi-dimensional Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS; Chen et al., 2015). The BPNSFS is a 24-item self-report measure of the degree to which one's basic needs of autonomy, relatedness, and competence are either satisfied or frustrated in general in one's life. The scale is comprised of six, 4-item subscales assessing autonomy satisfaction (e.g., "I feel a sense of choice and freedom in the things I do") and frustration (e.g., "most of the things I do I feel like 'I have to'"), relatedness satisfaction (e.g., "I feel that the people I care about also care about me") and frustration (e.g., "I feel excluded from the group I want to belong to"), and competence satisfaction (e.g., "I feel confident that I can do things well") and frustration (e.g., "I have serious doubts about whether I can do things well"). Participants are asked to indicate the degree to which each statement is true of their life on a 5-point Likert scale, ranging from 1 = *not true at all* to 5 = *completely true*. For the purposes of the present study, composite variables were created with mean scores for needs frustration and satisfaction with higher scores indicating higher frustration or satisfaction respectively.

Test Anxiety Subscale of the Motivated Strategies for Learning Questionnaire

The Motivated Strategies for Learning Questionnaire (MSLQ; Duncan & McKeachie, 1991, 2005) is a self-report questionnaire that assesses student's motivation and their learning strategies. Overall, this scale is comprised of fifteen different scales that can be used either all together or separately. For the purposes of the current study, we only included the test anxiety subscale. Students responded on a 7-point Likert scale from 1 = *not at all true of me* to 7 = *very true of me*. This subscale includes five items, with a sample item being, "When I take a test, I think about how poorly I am doing compared with other students." Higher scores indicate higher levels of test anxiety.

Results

Data Screening

Individuals who had the potential for two time points of data were included for analysis in the present study. In our sample, ($N= 147$), 72% of the participants had complete data (data at two time points). Prior to analysis, we assessed the relevant assumptions using SPSS version 25. Less

than 5% of cases were missing data across each variable. Missing data were missing at random (Little's MCAR test, $p = .895$). Full Information Maximum Likelihood (FIML) was used to estimate parameters for cases with missing data (Arbuckle, 1996). All variables met the assumptions of linearity, multicollinearity, homoscedasticity and independence. Variables also met the assumption of normality, with skewness and kurtosis values within acceptable limits (i.e., ± 3 ; Tabachnick & Fidell, 2007). See Table 1 for means, standard deviations, and bivariate correlations between all model variables.

To examine the associations between psychological needs and test anxiety across time, we conducted a cross-lagged analysis in MPlus version 7.2 (Muthén & Muthén, 2017) using maximum likelihood estimation (MLE). To evaluate model fit, the following fit indices were used: Root Mean Square Error of Approximation (RMSEA) with 90% confidence intervals, the comparative fit index (CFI; Hu & Bentler, 1998), the standardized root mean square residual (SRMR; Hu & Bentler, 1999) and having a nonsignificant chi-squared (χ^2) value (Kline, 1998). We used the following cut-offs as a guide to determine acceptable fit: a RMSEA less than .06, a CFI greater than .95 (Hu & Bentler, 1998) and an SRMR less than .08 (Hu & Bentler, 1999).

Descriptive Statistics and Bivariate Correlations

Test anxiety at Time 1 was significantly and negatively correlated with needs satisfaction at Time 1 and negatively associated with needs frustration at Time 1. There was a significant and medium-sized correlation between test anxiety at Time 1 and test anxiety at Time 2. At Time 2, there was a significant positive correlation between test anxiety and needs satisfaction, and a significant negative correlation with test anxiety and needs frustration. Lastly, needs frustration at Time 1 was significantly and positively correlated with needs frustration at Time 2, whereas there was not a significant correlation between needs satisfaction at Time 1 and needs satisfaction at Time 2 (see Table 1).

Cross-Lagged Analysis

In our model (see Figure 1), we tested cross-lagged effects from needs satisfaction and needs frustration at Time 1 to test anxiety at Time 2 and from test anxiety at Time 1 to needs satisfaction and frustration at Time 2 to establish temporal precedence. Further, we accounted for autoregressive paths (i.e., stability paths from Time 1 to Time 2) for needs frustration, needs satisfaction and test anxiety. Age and sex at baseline were also included as covariates in the model. Results indicated that model fit was acceptable ($\chi^2(2) = 4.17$, $p = .12$; CFI = .98; RMSEA = .086; 95% CI [.00, .20]; SRMR = .04). Further, the analysis showed that the autoregressive paths were significant and positive, indicating relative stability over time (see Table 2). Results indicated that being older and female significantly predicted higher levels of test anxiety. Finally, our findings revealed that greater needs frustration at baseline predicted greater test anxiety at Time 2 after accounting for baseline levels of test anxiety, needs frustration and satisfaction, age and sex (see Table 2).

Table 1.
Summary Statistics and Intercorrelations for all Variables.

Variable	1	2	3	4	5	6	7	8
1. Sex^a	-	-.09 [-.18, .28]	.22* [.12, .47]	.11 [-.08, .45]	.02 [-.19, .12]	.05 [-.13, .21]	.19 [-.18, .39]	.21 [-.15, .43]
2. Age		-	.08 [-.14, .30]	.26* [.08, .43]	-.03 [-.24, .19]	.25* [.06, .42]	-.04 [-.23, .15]	.03 [-.20, .23]
3. Test Anxiety T1			-	.54** [.36, .69]	-.32** [-.49, -.15]	.07 [-.18, .30]	.41** [.18, .62]	.12 [-.15, .38]
4. Test Anxiety T2				-	-.32** [-.49, -.12]	.07 [-.18, .29]	.43** [.22, .61]	.25** [.01, .47]
5. Satisfaction T1					-	.14 [-.10, .39]	-.58** [-.69, -.45]	-.11 [-.33, .12]
6. Satisfaction T2						-	.02 [-.22, .26]	-.47** [-.65, -.25]
7. Frustration T1							-	.32** [.05, .55]
8. Frustration T2								-
<i>M</i>	.57	14.82	22.86	22.49	14.06	12.76	11.12	11.49
<i>(SD)</i>	.54	1.28	7.70	7.16	2.56	3.21	3.24	3.13
<i>α</i>			.81	.75	.90	.90	.91	.90

Note: T1 = score at baseline; T2 = score at second time point. aSex was coded as 0=boy, 1=girl.
*p < .05, **p < .01, and ***p < .001.

Table 2.
Results of Cross-Lagged Model of Psychological Needs to Test Anxiety

Variable	Satisfaction T2				Frustration T2				Test Anxiety T2			
	B	S.E	β	95% CI	B	S.E	β	95% CI	B	S.E	β	95% CI
Satisfaction T1	.31	.11	.28*	[.09, .46]	N/A	N/A	N/A	N/A	.07	.28	.03	[-.19, .24]
Frustration T1	N/A	N/A	N/A	N/A	.40	.10	.42*	[.24, .60]	.73	.24	.34*	[.13, .54]
Test Anxiety T1	.07	.05	.16	[-.04, .36]	-.03	.05	-.06	[-.27, .15]	.31	.09	.32*	[.15, .49]
Sex	-.50	.66	-.08	[-.28, .12]	.02	.67	.00	[-.21, .21]	2.63	1.23	.19*	[.02, .36]
Age	.63	.25	.28*	[.07, .48]	.24	.24	.11*	[.10, .32]	1.18	.45	.24*	[.07, .40]

Note: N/A = Not Applicable due to that path not being tested

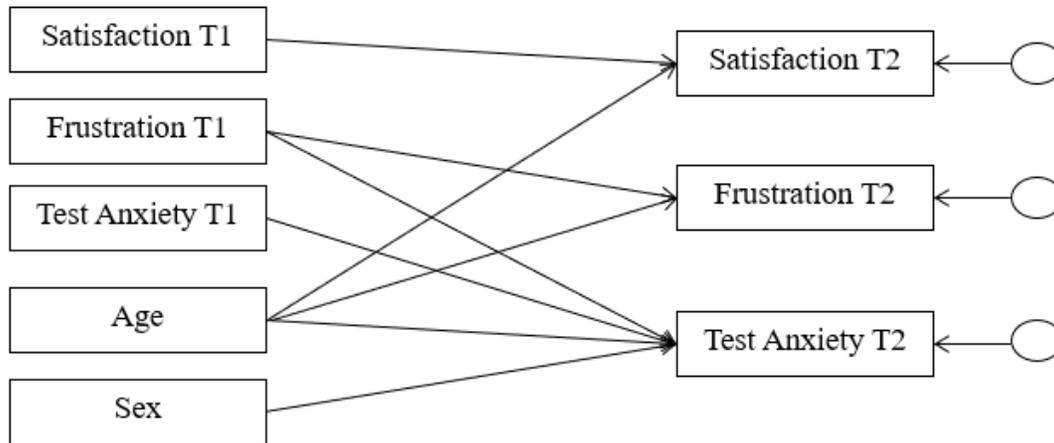


Figure 2. Final Cross-lagged Model of Psychological Needs at *Time 1* Predicting Test Anxiety at *Time 2*. Note: Sex coded as 0 = Boy, 1 = Girl. Only significant paths are indicated in diagram. All associations shown in diagram are positive. Covariances are not shown in the diagram for ease of presentation. Standardized and unstandardized values for significant and non-significant paths are presented in Table 2.

Discussion

The aim of this study was to gain a greater understanding of how psychological needs satisfaction and frustration are related to test anxiety over time in first-generation students. Overall, we replicated previous findings highlighting the role of basic psychological needs with regards to test anxiety (Maralani et al., 2018) while also extending previous findings by examining this association across time and within a specific population of first-generation students. Our hypotheses were partially supported as needs frustration at baseline significantly predicted test anxiety at Time 2. However, we did not find a significant association between needs satisfaction at baseline with test anxiety. First, our correlational findings indicated that needs satisfaction and frustration were significantly correlated with test anxiety at Time 1 and Time 2, respectively. This suggests that within time, both higher needs frustration and lower needs satisfaction are associated with higher levels of test anxiety. Next, our path model findings indicated that there were sex-related differences with respect to test anxiety such that female students reported greater test anxiety than male students. These findings are consistent with extant literature illustrating sex-related differences in the experience of test anxiety, such that female students tend to experience greater test anxiety on average than male students (Putwain & Daly, 2014; Zeidner, 1998). Our findings also indicated that there are age-related differences with respect to test anxiety such that older students reported greater test anxiety than younger students. This is consistent with previous research that found similar patterns of test anxiety with age (DordiNejad et al., 2011). A potential explanation for this is that as students grow older, they may become more aware of the importance of test outcomes in influencing their academic trajectories, and test scores in the upper years of high school tend to carry more weight than those in earlier years.

Our results indicated that there was no significant relationship between psychological needs satisfaction at baseline and test anxiety at Time 2 after accounting for the effects of psychological need frustration and test anxiety at baseline along with age and sex. However, the results indicated that psychological needs frustration was associated with increased test anxiety over time after accounting for psychological needs satisfaction and frustration, age and sex at baseline. This finding is consistent with preliminary evidence suggesting that the thwarting of basic psychological needs may be one risk factor for heightened test anxiety amongst students (Hejazi et al., 2014; Maralani et al., 2016; Maralani et al., 2018). More specifically, this finding adds to the literature by showing that the association between psychological need frustration and heightened test anxiety holds true over time and specifically, in first-generation students. Whereas our cross-sectional correlations showed a significant relationship between both needs frustration and needs satisfaction with test anxiety, it appears that when put into the same model over time, it is needs frustration that is significantly predicting test anxiety. These results are supported by evidence from a review by Vansteenkiste & Ryan (2013) that concluded that in general, needs satisfaction tended to be associated with intrinsic motivation and well-being, whereas needs frustration tended to be associated with maladaptive behaviour and ill-being. Another potential reason could be that for the purposes of our study we were interested in overall needs satisfaction and frustration, so we used composite scores (autonomy, relatedness and competence together). We chose to create composite scores to conserve statistical power and reduce potential multicollinearity. However, it is possible that there may be differences in needs satisfaction of each subscale and test anxiety, as previous research has found differences in relationships between the subscales of needs satisfaction and academic outcomes (Zhen et al., 2017).

Overall, our findings demonstrate that SDT is important to consider when it comes to educational outcomes such as test anxiety in adolescents. This theory has previously been shown to be relevant when it comes to the health and well-being of individuals and has been associated with other educational outcomes (Gutiérrez et al., 2018; Zhen et al., 2017). Our study adds to this literature suggesting that SDT is also important for studying test anxiety, specifically, that the meeting of basic psychological needs can be implicated in student levels of test anxiety. Whereas other studies have shown that SDT is playing a role in educational outcomes, our data allowed us to establish temporal precedence and highlight the importance of needs frustration in particular. Longitudinal data and analysis with regards to what is predicting test anxiety is particularly important for intervention efforts to improve educational outcomes.

Lastly, given that our study was specific to first generation students, who may be more at risk not attaining post-secondary education (Finnie, Wismer & Mueller, 2015), it is particularly important to ensure that psychological needs in this group are being met to help lower test anxiety with the goal of increased academic performance in this group. Previous research has found that this sample of students may be at risk for lack of social identification in a University setting which can affect their levels of test anxiety (Janke et al., 2017). Based on our findings, educators of high school students who will be the first to attain a post-secondary education should put forth an extra effort to ensure that psychological needs for autonomy, competence and relatedness are being met.

Limitations, Strengths, and Future Directions

This study is, of course, not without its limitations. Although we were able to test associations between psychological need satisfaction and frustration and test anxiety over time, which allows for some degree of temporal precedence to be set, we did so within a relatively small sample. Whereas small sample size limits statistical power and increases the margin of error, our study had a within-subject design which grants us greater power. Future research may seek to replicate these findings in a larger sample to improve reliability of findings. Given that this sample is part of an ongoing longitudinal study, we hope to replicate these findings in a larger sample and across more time points in future research. It is also worth noting that our sample was from one specific school. Although students who attend this school come from throughout the region and not a specific neighbourhood around a school, our sample still limits the generalizability of our results. However, our sample is a unique high-risk community sample as all students who attended are first-generation students. Although this is an important group to study given that first-generation students tend to be at heightened risk for poorer educational outcomes (Finnie et al., 2011; Finnie et al., 2015; Petty, 2014; Smith & Gottheil, 2011; Stephens et al., 2014), future research should seek to replicate this model in broader student populations in an effort to improve the generalizability of findings.

With regards to ethnicity, our sample was relatively homogenous. It would be beneficial for future researchers to consider associations in a more ethnically diverse sample or within specific minority populations given that a wealth of research suggests an achievement gap between students of ethnic minority backgrounds and their white peers (Norman et al., 2001; Rowley & Wright, 2011), even when students demonstrate similar levels of ability (Kotok, 2017).

Another potential limitation of our study is that our measure of test anxiety may not have been the most robust. We chose to use the test anxiety subscale of the Motivated Strategies for Learning Questionnaire (MSLQ) as this survey is effective in measuring a broad range of motivations that may be associated with educational outcomes. However, other measures of test anxiety may measure this construct in adolescents more comprehensively. For example, The Test Anxiety Inventory for Children and Adolescents (Lowe et al., 2008) is a multi-dimensional scale that measures a wide range of aspects of test anxiety. Finally, our study included two time points which allowed us to establish temporal precedence, but it does not allow for us to examine trajectories of change in psychological needs satisfaction and frustration and how these changes may be related to changes in test anxiety. However, our study is the first to our knowledge to establish temporal precedence within these relationships within a first-generation student sample. Therefore, while our findings are important at establishing this relationship over time, future research should look to further examine this relationship across more time points. Educationally, future research should be directed towards better understanding how teachers and schools may support students in meeting their needs of competence, autonomy, and relatedness.

Educational Implications

Given that psychological need frustration predicted test anxiety over time, and test anxiety is a robust predictor of academic performance, these findings hold important implications for educators. Test anxiety has figured prominently as a contributor to poor academic performance (Zeidner, 1998). Thus, it is crucial to uncover key predictors of test anxiety among students to direct prevention and intervention efforts. Based on our findings, research and intervention efforts may be directed towards elucidating ways in which educators can create classroom environments in which students perceive their psychological needs of competence, autonomy and relatedness to be met. For example, Maralani and colleagues (2018) suggest that providing students with an active role in the classroom (e.g., providing feedback, selecting classroom activities, discussing their preferences) may boost students' sense of autonomy, and may similarly provide students with opportunities to communicate and feel supported by their teachers and peers, potentially contributing to feelings of relatedness. Similarly, classroom activities aimed at improving student's self-efficacy may aid in satisfying student's need for competence. Indeed, self-efficacy has been positively associated with academic performance and preliminary evidence suggests that self-efficacy may act as a protective factor against test anxiety (Nie, Lau, & Liao, 2011).

Preliminary findings from Cheon, Reeve, and Yong-Gwan (2016) offered support for a teacher-focused intervention, whereby teachers were taught means to be more autonomy-supportive and less controlling, in reducing psychological need frustration in physical education students over time. Given that our findings found a relationship between psychological need frustration and test anxiety, but not psychological need satisfaction, the utility of this intervention appears promising. Students of teachers who participated in the intervention demonstrated greater perceived autonomy support, higher psychological need satisfaction, lower psychological need frustration and lower perceived teacher control than students whose teachers were in the control group (Cheon et al., 2016). As such, teacher-focused interventions may act as a potentially useful tool to facilitate student's needs for autonomy, competence and relatedness to be met in the classroom, and to reduce test anxiety. Future research should aim to evaluate such interventions in broader educational settings and should include test anxiety among the study variables.

Conclusion

Overall, our study has multiple important take home points. First, we replicated previous findings that found significant associations between basic psychological needs and test anxiety, further establishing the important role of psychological needs in test anxiety. Second, we extended these findings across time to establish temporal precedence. Finally, we extended this research to a unique and specialized sample of first-generation students. In sum, our results support the key role of need frustration in predicting greater test anxiety over time among first generation students attending secondary school.

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