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ORIGINAL PAPER

Predicting college students' psychological distress through basic psychological need-relevant practices by teachers, peers, and the academic program

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Abstract
Psychological distress (PD) is highly prevalent among college students. However, not much is known about the role study programs can have in fostering or reducing PD. Two studies were conducted to assess the importance of study program climate in predicting students PD, in addition to that of teachers and peers. In Study 1 ($N = 1855$), we developed and confirmed the validity of a questionnaire assessing need supportive/thwarting practices emitted by college teachers, peers, and study programs using a bifactor approach. In Study 2 ($N = 1797$), we relied on this questionnaire to investigate the prediction of students' PD. Our findings showed that, taken individually, global levels of need support/thwarting from each source appear to be more important predictors of students' PD than need-specific subfactors. Taken concurrently, the importance of need support by teachers was marginal while need thwarting by peers and study programs had the strongest prediction of students' PD. Overall, study program climate may be an important overlooked factor spiraling students' PD.

Keywords Self-determination theory · Need support · Need thwarting · Study program climate · Psychological distress

Psychological distress is highly prevalent among college students worldwide (Sharp & Teiler, 2018). As a global state of emotional suffering, psychological distress is mainly characterized by symptoms of anxiety (e.g. restlessness, feeling tense, nervousness) and depression (e.g. sadness, lost interest, hopelessness; Drapeau et al., 2012; Ridner, 2004). In this respect, studies have reported that anxiety and depression were experienced by as much as 30% of college students (Bruffaerts et al., 2018; Ibrahim et al., 2013). The emotional disturbance and mental discomfort that is inherent to psychological distress can have numerous detrimental effects on college students' lives. On the one hand, psychological distress is associated with signs of reduced academic functioning such as lower achievement, missing important academic obligations and voluntarily dropping out of college (Sharp & Theiler, 2018). On the other hand, students suffering from psychological distress have greater suicidal tendencies and are at greater risk of subsequent onset of multiple emotional and physical health conditions (Izadinia et al., 2010; Scott et al., 2016). Understanding why several college students are struggling with symptoms of psychological distress such as anxiety and depression is thus of central importance.

Psychological distress has complex manifestations and etiology. Its predictors are of various natures, some pertaining to individuals and their personal resources (e.g. education, income, self-esteem), and others to contextual factors (Drapeau et al., 2012). With this regard, the goal of this study was to assess how specific aspects of the college context are associated with students' psychological distress. More specifically, we used the framework of self-determination theory (SDT; Ryan & Deci, 2017) to investigate supportive and detrimental practices of three distinct sources at the college level (peers, teachers, and the general climate in study programs) and test whether they significantly predict students' psychological distress.

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Psychological need satisfaction in self-determination theory

According to SDT, the satisfaction of the basic psychological needs for autonomy, competence, and relatedness at school is a key ingredient for the actualization of students' optimal functioning and psychological well-being (Deci et al., 2013). On the contrary, the frustration of these needs is expected to alter students' development and increase symptoms of ill-being and even psychopathology (Vansteenkiste et al., 2020).

The need for *autonomy* refers to the experience of volition and self-endorsement and its satisfaction arises from the possibility for students to act in accordance with their choices, interests, and values (Vansteenkiste et al., 2020). The frustration of autonomy refers to the experience of being controlled by others, and feeling pressured to act in a certain way. The need for *competence* concerns the perception of effectiveness and mastery and is satisfied when students have opportunities to use and improve their skills (Deci et al., 2013). Competence frustration arises from a sense of failure and under-accomplishment. The need for *relatedness* refers to the need for care and consideration from others. Relatedness is satisfied when students feel positively bonded to important figures within the college context whereas relatedness frustration stems from social exclusion and feelings of loneliness (Ryan & Deci, 2017).

To help satisfy their psychological needs, students must be exposed to need supportive practices from significant sources within the college context (Ryan & Deci, 2020). Need supportive practices are autonomy support, structure (i.e. competence support), and involvement (i.e. relatedness support). On the opposite, need thwarting practices are control (i.e. autonomy thwarting), chaos (i.e. competence thwarting), and negligence (i.e. relatedness thwarting) (Vansteenkiste et al., 2020). Table S1 of the online supplementary material presents the general features in each dimension of need support and need thwarting.

To this day, peers and teachers have been identified as important sources of need support helping prevent college students' psychological distress. For example, one study showed that autonomy support provided by peers was a positive predictor of college students' subjective well-being (Ratelle et al., 2013). Moreover, a longitudinal study revealed that law students' perception of autonomy support provided by their faculty predicted higher levels of need satisfaction (Sheldon & Krieger, 2007). Need satisfaction was in turn linked to higher subjective well-being and self-determined motivation to pursue the upcoming legal career (i.e. pursuing a career because of its importance and/or the pleasure it provides). Another study linked need support from college teachers with academic motivation and achievement, through need satisfaction (Leenknecht et al., 2017).

The importance of need support from peers and teachers lies in the fact that these two sources represent important actors in college students' lives. Indeed, the college context encourages students to meet new people and develop social networks (Alsubaie et al., 2019). As such, students share many experiences with their peers at college which can contribute to the development of close relationships characterized by a sense of mutuality and equality (Collins & Madsen, 2006). Such relationships have the potential to make peers an important source of support as they can provide empathy, guidance, and encouragement when needed (Li et al., 2018). As for teachers, they are prominent figures whom frequently interact (although not always individually) with students. In doing so, they become responsible for shaping important facets of students' educational experience, playing a central role in their adjustment to college. Teachers' importance for students' general adjustment to college has led researchers to qualify them as "first-line responders", who can help students' in facing the escalation of psychological distress through college years (Di Placito-De Rango, 2018).

Furthermore, although researchers acknowledge that teachers and peers are important sources of need support for students (Leenknecht et al., 2017; Ratelle et al., 2013), it would also be relevant to expand this list to other sources such as the general institutional climate. Indeed, some aspects of students' experience of autonomy in college, such as having elective courses or the possibility to share opinions on the quality of the curriculum, are not under the sole control of teachers (Ryan & Deci, 2020). The same goes for experiences of competence (e.g. having easy access to curriculum information that can affect students' progress) and relatedness (e.g. having opportunities to meet peers and teachers through organized events). In fact, "*many teachers are forced to find ways to support learners' psychological needs despite institutional obstacles such as mandated curricula, controlling performance pressures, grading requirements, and high-stakes tests*" (Ryan & Deci, 2020, p. 9). While such elements may weigh heavily on students' need satisfaction, they are not the result of the interaction with one particular, tangible agent (e.g. administrators, administrative agents), but are rather factual circumstances that derive from program committee orientations and legacy. Students are exposed to this educational structure that influences their academic experience on a day-to-day basis (Bess & Dee, 2008). In addition to the contributions of teachers and peers, a need supportive program climate may further contribute to students need satisfaction. Conversely, obstacles to students' need satisfaction that pertain to study programs could overweight the benefits of having need supportive peers and teachers. Need-related practices relative to the study program climate could thus independently predict students'

psychological distress over and above the practices emitted by other sources. This, however, has been oversighted in recent research on psychological need satisfaction and frustration at school.

Overall, peers, teachers, and the study program climate could be important actors contributing or helping prevent psychological distress in college students. However, there are two important shortcomings in the actual literature that need to be addressed to further expand our comprehension of how need-related practices from these actors interact with students' psychological distress. First, a limited number of studies have investigated peers' and educators' need-related practices and their association with students' psychological distress and no previous research has looked at the effect of the study program climate. Moreover, these three sources may each affect students' psychological distress in their own way, making it important to examine their relative contribution. However, no studies have done so simultaneously.

Second, although SDT postulates that environments can support the basic psychological needs, leading to need satisfaction, another process is also suggested, where the environment thwarts the psychological needs, leading to need frustration. Need thwarting and need support are considered to represent different experiences (Vansteenkiste & Ryan, 2013). To explain this distinction, SDT researchers have proposed a dual-process model which differentiates need-based experiences and their related outcomes (e.g. Bartholomew et al., 2011; Jang et al., 2016). According to this model, need supporting practices facilitate positive outcomes in students through their positive effects on need satisfaction while need thwarting practices facilitate negative outcomes because of their positive effects on need frustration. In support of this model, need frustration among college students has been linked to symptoms of depression, anxiety, and emotional exhaustion (Nishimura & Suzuki, 2016; Sandrin & Gillet, 2016). While this result is interesting, no previous research has looked at whether this effect of need frustration on psychological distress stems from need thwarting in the educational environment. Indeed, the majority of studies on contextual predictors of students' adjustment focused on the predictive roles of autonomy support or akin constructs (e.g. Leenknecht et al., 2017). To fully understand how the college context contributes to students' psychological distress, it would be crucial to assess the predictive role of both need thwarting practices and need supporting ones.

In general, these shortcomings all point toward the fact that practical tools needed to conduct an investigation of the combined contributions of need support and thwarting from multiple sources in the college context are lacking. Indeed, scales used to assess university students' perception of need support from teachers were either developed with primary or high school teachers (e.g. Teacher as a Social Context Questionnaire; Belmont et al., 1988) or developed to assess need support in various educational contexts in a very general fashion (e.g. Learning Climate Questionnaire; Williams & Deci, 1996). General scales do not target specific need supportive practices enacted by teachers or peers which reduces the accuracy in the measurement of those practices. Scales validated in primary and high school teaching contexts do not take into account the specificities of post-secondary education. To our knowledge, no scale has circumvented these shortcomings by specifically targeting need supportive and need thwarting practices emitted by teachers and peers at the college level. Moreover, there is no existing validated scale measuring study programs' need supportive and need thwarting experiences in students. Such an instrument would be crucial to identify need-relevant practices that may represent intervention targets for contributing to student adjustment.

The present research

In light of the numerous gaps in the literature highlighted above, the main objective of this research was to test the importance of need support and thwarting from various sources in predicting students' psychological distress, as well as the contribution of the study program climate over and above that of teachers and peers' need-related practices. To do so, we first needed to develop and validate scales assessing need supportive (S) and need thwarting (T) practices for all three psychological needs, namely autonomy (A), competence (C) and relatedness (R), yielding six dimensions (AS, CS, RS, AT, CT, RT). We developed such scales for college teachers (scale 1), college peers (scale 2), and study program climate (scale 3) and tested the following hypotheses:

H1 For each provider, we will distinguish three specific factors of need supportive practices, three specific factors of need thwarting practices, and one factor encompassing global levels of need support and need thwarting.

H2$_a$ For each provider, need supportive practices (AS, CS, RS) will show convergent and discriminant validity[1] by being positively linked to students' need satisfaction and negatively related to students' need frustration (autonomy, competence, relatedness).

H2$_b$ For each provider, need thwarting practices (AT, CT, RT) will show convergent and discriminant validity by being positively linked to students' need frustration and negatively

[1] A definition of the different types of validity used in this article is available in the first section of the online supplementary material.

related to students' need satisfaction (autonomy, competence, relatedness).

For each provider, we then predicted students' psychological distress from each dimension of need-related practices (AS, CS, RS, AT, CT, RT). Based on previous research regarding the association between need support/thwarting constructs and indicators of mental health (Ratelle et al., 2013; Vansteenkiste et al., 2020), our third (H3) hypothesis was that:

H3$_a$ For each provider, need supportive practices (AS, CS, RS) will be negative predictors of students' psychological distress.

H3$_b$ For each provider, need thwarting practices (AT, CT, RT) will be positive predictors of students' psychological distress.

We then assessed the concurrent contribution of need support and need thwarting emitted by the three providers in predicting students' psychological distress. In light of the potential importance of the study program climate, we proposed that:

H$_4$ Study program climate will predict students' psychological distress beyond the contribution of teachers and peers.

Study 1

The purpose of Study 1 was to develop and validate a questionnaire measuring need support and thwarting by teachers, peers and relative to the study program climate. Following H1, we predicted that the three scales would show factorial validity and that same-source items could be meaningfully aggregated in a global factor of need support and thwarting. Following H2, we expected the scores derived from the three scales to show construct validity in their associations with need satisfaction and frustration. We finally expected the scales to be invariant across genders.

Method

Item development and selection

Based on previous work in the SDT literature (e.g. Rocchi et al., 2017), a sequential procedure consisting of four steps was used to develop an initial pool of items for each source. First, conceptual definitions for the six dimensions of need-related practices were collated (see Table S1 of the online supplementary material). Second, items from published and unpublished measuring instruments assessing need support and/or thwarting were gathered (see Table S2 of the online supplementary material for references to these scales). When they referred to another educational context, these items were reframed toward the post-secondary education context. Third, we created new items with specific need-related practices in mind for all six dimensions of the three sources (see Table 1 for examples) until reframed and new items amounted to at least five items per dimension, but it could be much more. This led to an initial pool of 415 items. Lastly, we submitted these items to 25 researchers in the field of motivation and asked them to assess their content validity (clarity, relevance, and belongingness to a dimension; see Sect. 1 of the online supplementary materials for more information on this procedure). They selected 78 items for the teacher scale ($M = 13$ items per dimension, min = 8, max = 19), 27 items for the peer scale ($M = 4.5$ items per dimension, min = 4, max = 6), and 67 items for the study program scale ($M = 11.17$ items per dimension, min = 8, max = 13). This disparity in the number of items per scale is explained by the fact that many existing scales measuring need-related practices emitted by teachers were available in the literature, and their items were adapted for the initial pool of items of this scale. However, only one scale pertaining to need-related practices in the context of peer relationships was found, and none for elements related to the study program climate (see Table S2 of the online supplementary material). Thus, for these two scales, a majority of items were created by the authors of this publication, which resulted in fewer items.

Participants and procedure

Following ERB approval, we sent an email to 21,039 undergraduate students meeting our inclusion criteria (i.e. being registered in a disciplinary major) during the fall semester of 2018. These students were from a large French-speaking Canadian university located in the province of Quebec. We asked them to complete an online questionnaire. Participation was voluntary and anonymous. In total, 1855 students completed at least one full scale in the questionnaire, for a participation rate of 8.82%. Demographic characteristics of the sample are presented in Table 2.

Measures

College need support/thwarting questionnaire (CNSTQ) We asked participants to complete the teacher scale (78 items), peer scale (27 items) and study program scale (67 items). Each of these scales assesses students' perception of the provision of need support and need thwarting by the three sources, leading to a total of 18 subscales measured by 172 items. Using a 7-point Likert-type scale (1 = *Strongly agree*, 7 = *Strongly disagree*), participants were asked to indicate to

Table 1 Example(s) of Specific Need-Related Practices for Each Source

Source	Example(s) of Specific Need-Related Practices
Teachers	
Autonomy-Support (AS)	Letting students choose subject in assignment Encouraging divergent opinions
Competence-Support (CS)	Course goals are stated clearly Concrete tips help students improve their skills
Relatedness-Support (RS)	Appreciation and interest in students Being understanding of students
Autonomy-Thwarting (AT)	Competition and other tools are used to control students No rationale accompanying teachers' requests
Competence-Thwarting (CT)	Course goals are constantly changing No feedback is given to students
Relatedness-Thwarting (RT)	Relationships with students are disinterested Teachers are unavailable for students
Peers	
Autonomy-Support (AS)	Students accept each other's individuality
Competence-Support (CS)	Students are cooperative
Relatedness-Support (RS)	Students show understanding and respect
Autonomy-Thwarting (AT)	Students try to control others' behaviors
Competence-Thwarting (CT)	Students' actions are not predictable
Relatedness-Thwarting (RT)	Students don't care about others
Study Program	
Autonomy-Support (AS)	Many course options are available Course relevance is explained
Competence-Support (CS)	Information on the study program is easily and quickly accessible Information on the study program is clear
Relatedness-Support (RS)	Networking activities are encouraged and organized Teamwork opportunities are offered
Autonomy-Thwarting (AT)	Comments and suggestions for improvements are not welcome Some mandatory courses are perceived as irrelevant
Competence-Thwarting (CT)	Information on the study program is confusing No support is offered to students
Relatedness-Thwarting (RT)	The workload limits social life Networking is not encouraged and seen as a waste of time

what extent they agreed to their teachers, peers and program displaying each need-related practice.

Need satisfaction and need frustration To assess participants' levels of satisfaction and frustration of their needs for autonomy, competence, and relatedness, we asked them to complete the French version (Chevrier & Lannegrand, 2021) of the Basic Need Satisfaction and Frustration Scale (BPNSF; Chen et al., 2014). This scale is composed of 24 items divided in six subscales (one satisfaction subscale and one frustration subscale for each basic need). Following a stem indicating, "In general in college…", participants were asked to answer items such as "I feel a sense of choice and freedom in the things I undertake " (autonomy satisfaction), "I have the impression that people I spend time with dislike me" (relatedness frustration) and "I feel I can successfully complete difficult tasks" (competence satisfaction). Items were answered on a 7-point response scale (1 = *completely false* to 7 = *completely true*). In this study, omega coefficients of composite reliability (McDonald, 1970) for the six subscales were adequate, ranging from 0.87 to 0.95 ($M = 0.90$).

Analyses

All models were estimated with Mplus Version 8.3 (Muthén & Muthén, 2017) using the weighted least square mean and variance adjusted (WLSMV) estimator for categorical indicators. The fit of each model was evaluated using the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root Mean Square Residual (SRMR). The CFI and TLI test the adequacy of the proposed model in comparison to the null model (i.e. all links are fixed to 0), while RMSEA and SRMR test if residuals are at acceptable values. TLI and RMSEA control for model complexity,

Table 2 Students' Demographic Characteristics

Variables	Study 1	Study 2
Mean age (SD)	23.18 (4.88)	21.58 (4.95)
Gender		
Male	26.2%	19.7%
Female	73.2%	79.1%
Other	0.07%	1.01%
Missing	3	10
Parents' born in Canada	90.7%	79%
Missing	6	21
Parents' education level		
Primary school	1.3%	1.3%
High school	6.3%	5.7%
Vocational studies	11.7%	12.6%
College (CÉGEP)	24.7%	21%
Undergraduate studies	32.5%	33.7%
Master or Doctorate	22.7%	25.6%
Missing	23	54
Residency status		
Canadian citizen	96%	89.3%
Permanent resident	1.5%	2.7%
Foreign student	2.5%	8%
Missing	3	8
Living status		
With parents	34.2%	43.1%
Apartment	53.3%	44.8%
Student residence	4.9%	6.9%
Other	7.6%	5.2%
Missing	5	10
GPA		
Less than 2.00	2.6%	2.8%
Between 2.00 and 2.49	7.8%	7.6%
Between 2.50 and 2.99	18.5%	18.5%
Betwenn 3.00 and 3.49	31.1%	32.7%
Between 3.50 and 3.99	31%	29.3%
4.00 and more	8.9%	9.1%
Missing	18	389

SD standard deviation

while CFI and SRMR do not. Values greater than 0.90 and 0.95 for both the CFI and TLI respectively indicate adequate and excellent fit to the data, while values smaller than 0.06 and 0.08 for the RMSEA and SRMR respectively suggest an excellent and acceptable model fit (Hu & Bentler, 1999).

Confirmatory factor analyses (CFA) were conducted within subdimensions to select the most representative and specific items for each subscale of the CNSTQ. In successive rounds of CFA analyses detailed in the second section of the online supplementary material, each subscale was first tested on its own (18 CFA total at this step), reducing the number of items per scale down to 4 to 5 items. Then, each subscale was tested in an individual CFA with one of the five subscales within each source (15 CFA per scale, total of 45) to test for discriminant validity. Items with strong cross-loadings with other dimensions were deleted at this point, narrowing the number of items per subscale to 4, except four subscales which only had 3 items remaining.

Next, to assess the ability of the selected items to define a general factor of need support/thwarting for their respective source, we moved from CFA to the bifactor-exploratory structural equation modeling framework (bifactor-ESEM; Morin et al., 2016). This decision was based on recent work demonstrating that practices of support and thwarting of the basic psychological needs are best represented by a bifactor-ESEM model compared to models estimated with traditional approaches (e.g. CFA or bifactor-CFA; Tóth-Király et al., 2020). More specifically, a model composed of one global factor (G-factor) and six specific factors (S-factors) was shown to be more precise in estimation. In this model, the G-factor is defined by all available items of need support (with positive factor loadings) and need thwarting (with negative factor loadings) and represents the globality of need nurturing practices emitted by a source. Although this G-factor is postulated to carry one's perceptions of need support/thwarting, it also coexists with specific levels of imbalances in the support and thwarting of each need (i.e. the dimensions AS, CS, etc.), which are represented by the S-factors (Tóth-Király et al., 2020). In other words, the G-factor allows to consider the commonalities present among the ratings of each dimension of need-related practices while the S-factors acknowledge that distinctions unexplained by the G-factor also exist at the subscale level (Morin et al., 2016).

In addition to considering the hierarchical nature of a measure (i.e. by estimating a G-factor), the bifactor-ESEM framework also takes into consideration its complex multidimensionality (Morin et al., 2016). This is done by allowing theoretically relevant cross-loadings in the model specification (Marsh et al., 2014). This is particularly important in the present case given that constructs of need support and need thwarting are conceptually (Ryan & Deci, 2020) and empirically (e.g. Ahn et al., 2018; Leenknecht et al., 2017; Sierens et al., 2009) related, and in ways that transcend their general commonality in the form of the G-factor (Tóth-Király et al., 2020). Therefore, cross-loadings were expected between the six dimensions of need-related practices within each source and ignoring them could lead to biases in estimated factors and parameters (Marsh et al., 2014). Indeed, it was shown that unmodeled cross-loadings promote inflated estimates of factor correlations in CFA, or of the G-factor in the case of bifactor-CFA (Morin et al., 2016; Murray & Johnson, 2013). Thus, given that the teacher, peer, and study program scales are composed of six conceptually related dimensions, controlling for cross-loadings appears to be crucial in reducing risks of construct misspecification.

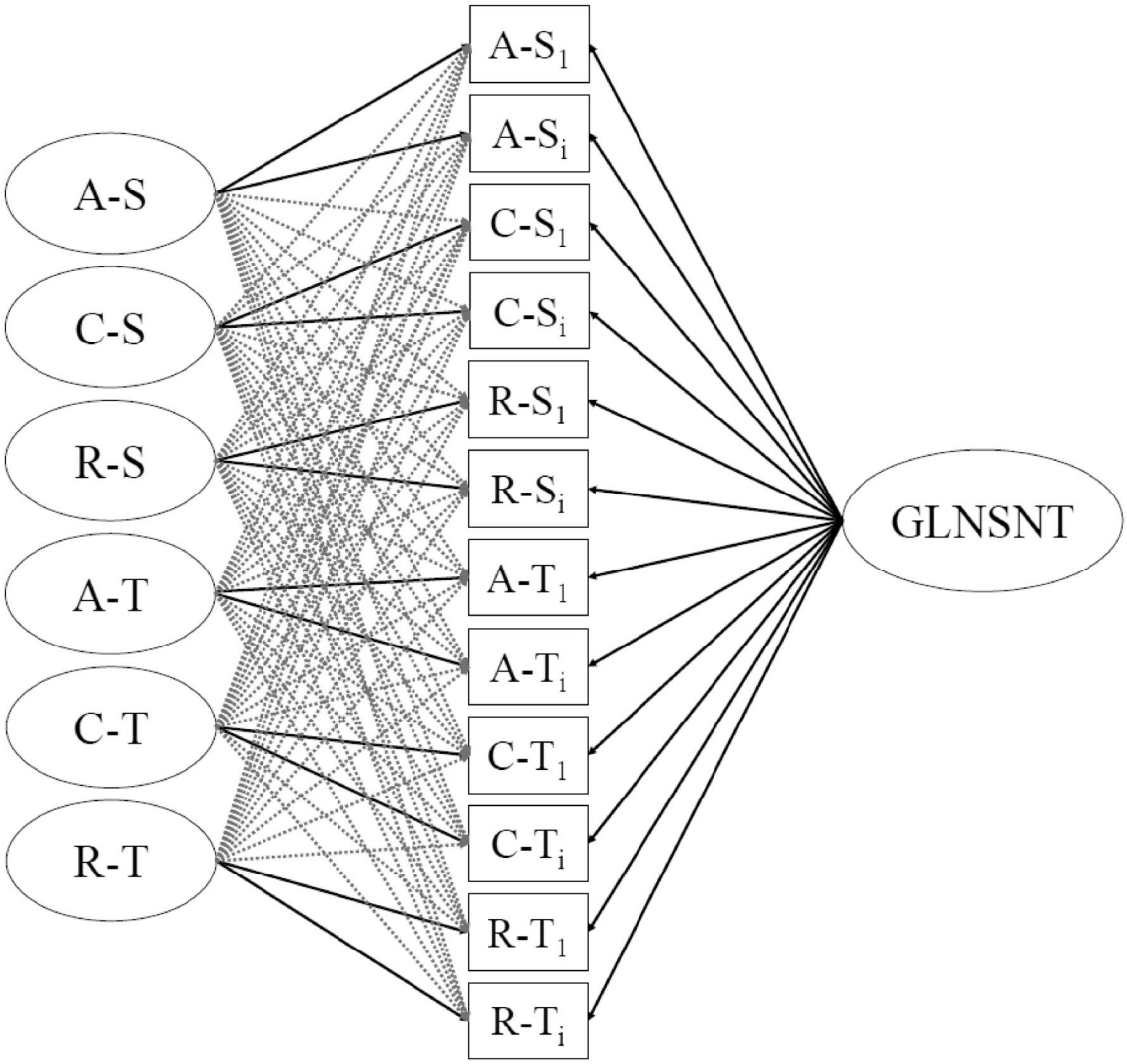

Fig. 1 Representation of the bifactor-ESEM model tested for the three scales of the CNSTQ. *AS* Autonomy support; *AT* Autonomy thwarting; *CS* Competence support; *CT* Competence thwarting; *RS* Relatedness support; *RT* Relatedness thwarting; *GLNSNT* Global levels of need support and need thwarting; Ovals represent latent factors; Rectangles represent observed indicators; Factor loadings are represented by full directional arrows; Cross-loadings are represented by dashed directional arrows; Factor variances and item uniqueness are not included in the figure for purpose of simplicity

Based on the results of Tóth-Király et al. (2020), we estimated three bifactor-ESEM models (one for each source) encompassing need support and need thwarting subdimensions (Autonomy, Competence, Relatedness, Support and Thwarting; AS, CS, RS, AT, CT, RT) while also including a global factor of need support/thwarting (see Fig. 1). The G-factor of these models was defined by all items in the model while the S-factors were also defined by all items but with non-target loadings being constrained to be as close to zero as possible (Morin et al., 2016). Each model was specified using orthogonal target rotation. Moreover, based on its advantages compared with traditional scale score reliability estimates (e.g. alpha; see Sijtsma, 2009a, 2009b), we used McDonald's (1970) omega to assess the composite reliability of each model. At this point, latent correlations between the CNSTQ and students' levels of need satisfaction and frustration were assessed to establish construct validity of the CNSTQ dimensions. In that regard, where bivariate correlations were tested in this study, considering the large sample size and the large number of correlations tested, a stricter alpha of 0.001 was chosen (Kim & Choi, 2021).

Finally, invariance tests were performed on the bifactor models to ensure that the teacher, peer and study program scales performed equally across students' gender. Following the procedure proposed by Svetina et al. (2019) for categorical data, three models were tested to determine whether gender invariance was supported. These models were (1) a baseline multigroup model where the same previously validated

Table 3 Bifactor-ESEM Solutions Fit Indices

	χ^2	df	CFI	TLI	RMSEA (90% CI)	SRMR
Study 1						
Teacher scale	429.20	129	0.994	0.988	0.035 (0.032–0.039)	0.011
Peer scale	468.12	98	0.994	0.985	0.047 (0.043–0.051)	0.010
Program scale	216.55	98	0.997	0.992	0.028 (0.023–0.033)	0.008
Study 2						
Teacher scale	383.56	129	0.989	0.976	0.047 (0.042–0.052)	0.015
Peer scale	381.71	129	0.994	0.987	0.048 (0.042–0.054)	0.013
Program scale	396.58	129	0.986	0.971	0.052 (0.046–0.058)	0.015

ESEM exploratory structural equation modeling; χ^2 chi-square test of exact fit; *df* degrees of freedom; *CFI* comparative fit index; *TLI* tucker-Lewis index; *RMSEA* root mean square error of approximation; 90% *CI* 90% confidence interval of the RMSEA; *SRMR* standardized root mean square residual

bifactor-ESEM was estimated for males and females concurrently, (2) a model where thresholds were constrained as equal between genders, and (3) a model with factor loadings and thresholds constrained as equal. On the premise that one model was satisfactory, the next model was evaluated.

Results

Of the 1855 students who completed at least one complete scale of the CNSTQ (the teacher scale was presented first and had a higher response rate), 1417 completed all the measures of this study. Missing data (% missing values: 12.75%) were handled with the pairwise present approach (Muthén & Muthén, 2017), meaning that each tested model uses all available data when estimating its components. WLSMV coupled with pairwise present has been shown to be more accurate than estimators based on listwise deletion (Asparouhov & Muthén, 2010). It is also a robust estimation method to deal with missing categorical data when missingness is relatively low and sample size is adequate (Lei & Shiverdecker, 2020).

Scale structure

CFA helped us select 24 sound items for the teacher subscales, 22 for the peer subscales, and 22 for the program subscales. These items were evaluated again using the bifactor-ESEM framework. The fit indices of each of the three bifactor-ESEM solutions are presented in Table 3 and show that each model exhibited excellent fit indices. The examination of parameter estimates supports the presence of a well-defined global factor of need support/thwarting provided by teachers, peers, and relative to the study program climate (see Table 4). Moreover, within each bifactor-ESEM model, need support items loaded positively on the G-factor while need thwarting items loaded negatively.

Once global factors were taken into account, some S-factors were no longer relevant and retained low amounts of residual specificity. However, some S-factors still bore relative importance: for the teacher scale, those were AS, RS, AT, and RT; for the peer scale, those were AT and RT; for the study program scale, those are CS, RS, AT, CT, and RT (see Table 4). It is important to keep in mind that the traditional guidelines used to assess reliability are not suited to establish S-factor reliability, for which more flexibility is required due to shared variance between the G and S factors (Perreira et al., 2018). As such, omega coefficients for residual factors around or greater than 0.50 were interpreted. These results suggest that items in the teacher and peer scales predominantly play a role in defining the global levels of perceived need support/thwarting in those scales, leaving S-factors with a smaller weight. This is less true for the study program scale in which S-factors generally kept important amounts of residual specificity after estimating a G-factor of need-relevant practices at the program level.

Construct validity and invariance

Table 5 present correlations between all latent variables estimated in Study 1, providing information on construct validity of the CNSTQ dimensions. As hypothesized, need supporting constructs were positively related to students' need satisfaction ($M_r = 0.40$, $SD_r = 0.17$) and negatively to students' need frustration ($M_r = -0.35$, $SD_r = 0.15$) while need thwarting constructs were negatively related to students' need satisfaction ($M_r = -0.29$, $SD_r = 0.10$) and positively to students' need frustration ($M_r = 0.40$, $SD_r = 0.10$). Among all needs and all sources, need-specific support and thwarting were associated with students' same-need satisfaction and frustration in expected direction (e.g. competence support from teachers was associated positively with competence satisfaction and negatively with competence frustration). Most cross-need paths (support or thwarting of one need predicting satisfaction and frustration of other needs) were also significant and in expected directions, except for the AS subscale of the

Table 4 Study 1: Parameter Estimates of the Bifactor-ESEM Solutions

Items	λ							δ
	G-Factor	S-Factor 1 (AS)	S-Factor 2 (AT)	S-Factor 3 (CS)	S-Factor 4 (CT)	S-Factor 5 (RS)	S-Factor 6 (RT)	
Teacher scale								
T-AS$_1$	**.622**	**.377**	.194	.047	.007	−.007	.089	.424
T-AS$_2$	**.525**	**.292**	.041	.163	.123	.006	.066	.592
T-AS$_3$	**.591**	**.248**	.066	.093	.134	.039	.001	.556
T-AS$_4$	**.696**	**.444**	.005	−.007	−.058	.159	.044	.288
T-AT$_1$	**−.415**	.069	**.649**	.003	.136	.032	.080	.375
T-AT$_2$	**−.510**	.013	**.700**	−.011	−.060	.018	.073	.240
T-AT$_3$	**−.583**	.020	**.675**	−.001	.040	.059	.016	.198
T-AT$_4$	**−.573**	.085	**.427**	.106	.274	.032	−.010	.394
T-CS$_1$	**.665**	.060	.234	**.042**	.139	−.023	.102	.468
T-CS$_2$	**.753**	.087	.076	**.194**	−.025	.094	.069	.368
T-CS$_3$	**.599**	.108	.052	**.444**	−.081	.003	.060	.420
T-CS$_4$	**.563**	.056	−.028	**.323**	**−.053**	.086	.078	.559
T-CT$_1$	**−.558**	.017	.008	−.131	**.266**	.059	.042	.595
T-CT$_2$	**−.433**	.037	.259	−.112	**.424**	.045	.099	.540
T-CT$_3$	**−.651**	.051	.272	.085	**.283**	.096	.022	.403
T-CT$_4$	**−.609**	.112	.017	.061	**.102**	.209	.150	.537
T-RS$_1$	**.805**	.101	.021	.030	.130	**.267**	−.005	.252
T-RS$_2$	**.784**	.084	.064	.100	.055	**.380**	−.202	.176
T-RS$_3$	**.824**	−.001	.096	-.003	.106	**.348**	.056	.176
T−RS$_4$	**.769**	.046	.053	.003	**−.020**	**.449**	.055	.198
T-RT$_1$	**−.705**	.006	.140	.090	.048	−.092	**.083**	.458
T-RT$_2$	**−.691**	.150	.243	.088	.164	−.010	**.169**	.378
T-RT$_3$	**−.640**	.011	−.075	.166	−.194	.046	**.234**	.463
T-RT$_4$	**−.662**	.070	.119	.013	.141	−.056	**.627**	.127
Mean λ	.63	.34	.61	.25	.27	.36	.28	
Reliability (ω)	.96	.50	.83	.36	.36	.72	.46	
Peer scale								
P-AS$_1$	**.825**	**.319**	.091	.080	.095	.040	−.071	.188
P-AS$_2$	**.776**	**.128**	.080	.033	.128	.011	.032	.357
P-AS$_3$	**.862**	**.365**	.041	−.112	.022	−.075	.036	.101
P-AS$_4$	**.715**	**.094**	−.264	.045	.164	.133	.238	.308
P-AT$_1$	**−.462**	.059	**.641**	−.002	.095	.046	.034	.360
P-AT$_2$	**−.524**	−.009	**.645**	−.092	.066	.142	.108	.264
P-AT$_3$	**−.562**	.018	**.642**	.024	.089	−.049	.005	.261
P-AT$_4$	**−.568**	−.021	**.702**	.112	.147	−.017	.039	.148
P-CS$_1$	**.770**	.127	.059	**.171**	−.041	.006	.126	.340
P-CS$_2$	**.772**	−.073	.221	**.190**	−.229	.031	.170	.231
P-CS$_3$	**.776**	.045	.102	**−.132**	.045	**−.028**	.154	.342
P-CS$_4$	**.713**	.062	.037	**−.139**	.095	.102	.026	.447
P-CT$_1$	**−.698**	.142	.110	.049	**.001**	.085	.273	.396
P-CT$_2$	**−.658**	.166	.226	−.173	**.454**	.102	−.015	.241
P-CT$_3$	**−.606**	.056	.311	.107	**.203**	.066	.135	.458
P-CT$_4$	**−.447**	−.038	.225	−.002	**.437**	−.075	.123	.537
P-RS$_1$	**.873**	.093	.155	.046	.063	**−.024**	.013	.199
P-RS$_2$	**.851**	.107	.075	−.015	.102	**.075**	−.078	.236
P-RS$_3$	**.830**	−.026	.313	−.005	.084	**.244**	−.077	.139
P-RT$_1$	**−.771**	.029	−.042	.114	.146	−.233	**.420**	.137

Table 4 (continued)

Items	λ							δ
	G-Factor	S-Factor 1 (AS)	S-Factor 2 (AT)	S-Factor 3 (CS)	S-Factor 4 (CT)	S-Factor 5 (RS)	S-Factor 6 (RT)	
P-RT$_2$	**−.759**	.075	.129	.122	.001	.141	**.407**	.202
P-RT$_3$	**−.732**	−.074	.252	−.195	.035	.046	**.345**	.234
Mean λ	.71	.23	.66	.02	.27	.10	.39	
Reliability (ω)	.95	.29	.79	.09	.31	.08	.50	
Program scale								
S-AS$_1$	**.648**	**.213**	−.004	.069	.173	−.043	.107	.487
S-AS$_2$	**.546**	**−.186**	−.362	.049	.337	−.046	.022	.418
S-AS$_3$	**.645**	**.052**	−.001	.012	−.015	.166	.035	.553
S-AT$_1$	**−.525**	−.076	**.330**	.040	.068	.074	.024	.597
S-AT$_2$	**−.648**	−.037	**.533**	.049	.105	.042	.179	.248
S-AT$_3$	**−.574**	.236	**.471**	.113	−.022	.105	.168	.340
S-CS$_1$	**.720**	.078	.133	**.266**	−.127	.040	.089	.362
S-CS$_2$	**.656**	−.140	−.014	**.310**	.008	.063	.047	.447
S-CS$_3$	**.616**	−.004	.025	**.371**	.064	.023	.024	.478
S-CS$_4$	**.682**	.124	.211	**.246**	−.176	.058	.130	.363
S-CT$_1$	**−.693**	−.056	.034	−.082	**.515**	.028	−.010	.242
S-CT$_2$	**−.642**	−.007	.080	.006	**.279**	−.026	.101	.493
S-CT$_3$	**−.697**	−.048	−.144	−.005	**.199**	.054	.099	.439
S-CT$_4$	**−.631**	.027	.112	−.018	**.512**	−.024	.024	.325
S-RS$_1$	**.509**	−.053	−.011	.043	.017	**.637**	.071	.324
S-RS$_2$	**.524**	.054	.077	.078	−.014	**.571**	−.021	.384
S-RS$_3$	**.465**	.187	.042	.159	−.059	**.550**	.003	.416
S-RS$_4$	**.487**	−.226	.089	−.261	.086	**.408**	.078	.455
S-RT$_1$	**−.391**	−.053	.063	−.005	−.030	.044	**.870**	.080
S-RT$_2$	**−.330**	.036	.037	.065	−.036	.049	**.792**	.253
S-RT$_3$	**−.414**	.130	.111	.010	.107	−.011	**.677**	.329
S-RT$_4$	**−.471**	−.068	.031	.034	.049	−.005	**.742**	.218
Mean λ	.57	.03	.44	.30	.38	.54	.77	
Reliability (ω)	.95	.12	.60	.46	.60	.75	.92	

ESEM exploratory structural equation modeling; *T*- teachers; *P*- peers; *S*- study programs; *AS* autonomy support; *AT* autonomy thwarting; *CS* competence support; *CT* competence thwarting; *RS* relatedness support; *RT* relatedness thwarting; *λ* factor loadings (target loadings are in bold); *ω* omega coefficients; *δ* uniquenesses

study program climate scale which was not significantly linked to the satisfaction and frustration of students' needs for competence and relatedness. Lastly, goodness-of-fit results for the successive tests of gender invariance are reported in Table 6. For each source, the baseline model was adequately estimated for men and women simultaneously (CFI/TLI ≥ 0.95, RMSEA/SRMR ≤ 0.06). Based on the guidelines of Chen (2007), the threshold equivalence models as well as threshold and factor loading equivalence models for the teacher, peer, and study program scales further showed adequate measurement invariance (at each step, ΔCFI/TLI ≤ 0.010, ΔRMSEA ≤ 0.015, and ΔSRMR ≤ 0.010).

Brief discussion

The goal of Study 1 was to develop and validate three scales assessing need supportive and need thwarting practices provided by teachers, peers, and relative to the study program climate, with the ultimate purpose of testing their prediction of students' psychological distress. The obtained results support H1 as each dimension of need support (i.e. AS, CS, RS) and need thwarting (i.e. AT, CT, RT) in each source were found to contribute to a global factor of need support/thwarting in that source and, frequently, to an interpretable specific subfactor. Study 1 results also support H2$_a$ and H2$_b$ by showing that the dimensions of the CNSTQ relate to constructs of

Table 5 Study 1: Latent Correlations Between the Dimensions of the CNSTQ, Need Satisfaction, and Need Frustration

Scales	Need satisfaction			Need frustration			Mean	SD
	Autonomy	Competence	Relatedness	Autonomy	Competence	Relatedness		
Teacher scale								
G-factor	.565*	.409*	.382*	−.478*	−.406*	−.402*	3.36	.413
AS	.451*	.213*	.208*	−.336*	−.156*	−.157*	4.19	1.17
AT	−.349*	−.283*	−.197*	.434*	.362*	.412*	1.72	0.98
CS	.634*	.515*	.303*	−.561*	−.514*	−.292*	4.60	1.10
CT	−.306*	−.237*	−.230*	.328*	.315*	.331*	2.44	0.94
RS	.473*	.328*	.329*	−.310*	−.227*	−.257*	4.88	1.22
RT	−.389*	−.267*	−.259*	.468*	.393 *	.387*	2.31	1.07
Peer scale								
G-factor	.452*	.367*	.386*	−.376*	−.594*	−.612*	3.76	0.41
AS	.369*	.275*	.752*	−.192*	−.186*	−.600*	5.58	1.16
AT	−.287*	−.293*	−.258*	.338*	.360*	.478*	1.54	0.83
CS	.470*	.478*	.273*	−.360*	−.407*	−.280*	5.45	1.17
CT	−.327*	−.218*	−.673*	.272*	.275*	.674*	2.21	1.10
RS	.386*	.411*	.854*	−.207*	−.281*	−.684*	5.47	1.34
RT	−.264*	−.229*	−.297*	.412*	.391*	.567*	2.34	1.41
Program scale								
G-factor	.695*	.465*	.465*	−.557*	−.418*	−.432*	3.85	.515
AS	.366*	.054	−.051	−.310*	−.042	.079	4.53	1.27
AT	−.492*	−.206*	−.212*	.470*	.254*	.346*	2.83	1.32
CS	.589*	.482*	.464*	−.303*	−.329*	−.355 *	4.94	1.17
CT	−.326*	−.230*	−.249*	.427*	.323*	.345*	2.53	1.21
RS	.483*	.342*	.405*	−.326*	−.224*	−.241*	4.55	1.25
RT	−.407*	−.284*	−.174 *	.658*	.421*	.325*	3.60	1.65
Mean	4.84	5.24	5.30	3.63	2.68	2.03		
SD	1.34	1.28	1.39	1.45	1.48	1.17		
Reliability (ω)	.92	.95	.89	.87	.91	.88		

AS autonomy support; *AT* autonomy thwarting; *CS* competence support; *CT* competence thwarting; *RS* relatedness support; *RT* relatedness thwarting; *SD* standard deviation; *ω* omega coefficients. * $p < .001$

Table 6 Study 1: Gender Invariance Testing Results

Scale	χ^2	df	CFI	TLI	RMSEA	SRMR	Δ χ^2	Δ df	Δ CFI	Δ TLI	Δ RMSEA	Δ SRMR
Teacher scale												
Configural	625.902	282	0.993	0.987	0.036	0.014						
Thresholds	577.333	378	0.996	0.994	0.024	0.015	121.240	96	0.003	0.007	−0.012	0.001
Thresholds/loadings	732.074	497	0.995	0.995	0.023	0.018	173.924	119	−0.001	0.001	−0.001	0.003
Peer scale												
Configural	594.776	218	0.994	0.987	0.045	0.015						
Thresholds	607.533	306	0.995	0.993	0.034	0.016	155.253	88	0.001	0.006	−0.011	0.001
Thresholds/loadings	771.862	411	0.994	0.994	0.032	0.019	181.186	105	−0.002	0.001	0.002	0.003
Program scale												
Configural	369.912	218	0.996	0.991	0.030	0.012						
Thresholds	449.074	306	0.996	0.994	0.025	0.013	148.263	88	0.000	0.003	−0.005	0.001
Thresholds/loadings	603.298	411	0.995	0.994	0.025	0.018	174.504	105	−0.001	0.000	0.000	0.005

χ^2 robust chi-square test of exact fit; *df* degrees of freedom; *CFI* comparative fit index; *TLI* tucker-Lewis index; *RMSEA* root mean square error of approximation; 90% *CI* 90% confidence interval of the RMSEA; *SRMR* standardized root mean square residual; *Δ* change in fit indices from the preceding model in the sequence

need satisfaction and need frustration in the expected directions, supporting their construct validity.

Study 2

The purpose of Study 2 was to test hypotheses $H3_a$, $H3_b$, and H4 while validating the final form of the CNSTQ. To achieve this, we surveyed another sample of students and added measures of psychological distress to the questionnaire. We also added items to the peer and study program scales to ensure that all the subscales of the CNSTQ were comprised of 4 items.

Method

Participants and procedure

Following ERB approval, we contacted 12,153 undergraduate students by email during the fall semester of 2019, of which none had been contacted for Study 1. All participants were studying in disciplinary baccalaureates from two French-speaking Canadian universities and answered a questionnaire containing measures of need support and thwarting, psychological distress, and demographic information ($N = 1797$ for a response rate of 14.79%). Participation in the project was online, voluntary, and anonymous. Demographic characteristics of the sample are presented in Table 2.

Measures

College need support/thwarting questionnaire (CNSTQ) In its final form following Study 1, two dimensions of the peer (RS and RT) and study program scales (AS and AT) were composed of only three items. In accordance with Marsh and Balla (1994) who consider three items to be the acceptable minimum for a congeneric model but recommend four to five items per factor, we generated new items for these subscales to ensure better factorial validity. More precisely, five items were created for the peer scale (three for the RS subscale and two for the RT subscale) and four items were created for the study program scale (two for the AS and AT subscales). Participants completed the teacher scale (24 items) developed and validated in Study 1 as well as the slightly modified peer scale (27 items) and study program scale (26 items). Each scale measured perceived need supportive and need thwarting practices within the college context.

Anxiety We used the French version (Micoulaud-Franchi et al., 2016) of the GAD-7 (Spitzer et al., 2006) to measure participants' level of anxious symptoms. With this 7-item scale, participants rate how often they were bothered by symptoms of anxiety over the last 14 days (0 = *not at all* to 3 = *nearly every day*). Omega coefficient for this scale was 0.91.

Depression To measure participants' level of depressive symptoms, we used the French version (Carballeira et al., 2007) of the PHQ-9 (Kroenke et al., 2001). With nine items, participants were asked how often they struggled with depressive symptoms over the last 14 days (0 = *not at all* to 3 = *nearly every day*). Omega coefficient for this scale was 0.86.

Results

Of the 1797 students who completed at least one complete scale of the CNSTQ (usually the teacher scale which was presented first), 1492 completed all the measures of this study. Again, we tested all models using the WLSMV estimator with Mplus version 8.3 (Muthén & Muthén, 2017) and missing data (% missing values: 16.54%) were handled with the pairwise present approach (Muthén & Muthén, 2017). Moreover, because the prediction models tested in Study 2 already provide a conservative test that controls for shared predicted variance in dependent variables, an alpha level of 0.05 was chosen to avoid over-inflating the type II error rate (Kim & Choi, 2021).

Scale validation

Items selection and final model The newly developed items of the peer and study program scales were included one after another in a bifactor-ESEM model comprised of all other items from that source. To be selected, an item needed to load more strongly on its target factor than on non-target factors, as well as to have minimal impacts on fit indices. Following this procedure, we selected two new items for the peer and study program scales, meaning that all 18 subscales of the CNSTQ are now comprised of 4 items. The fit indices of the final model of each scale are presented in Table 3 while details of each bifactor-ESEM model replication from Study 1 are presented in Table S5 of the online supplementary material. The newly selected items of the peer and study program scales loaded more strongly on their target S-factor than on other S-factors and contributed strongly to their G-factor (see Table S5). As in Study 1, the G-factors of the teacher, peer, and study program scales were well-defined. As for the S-factors, most of them kept sufficient amounts of residual specificity after considering students' perception of global levels of need support provided by each source: AS, RS, AT, CT, for the teacher scale; AS, AT, CT, and RT for the peer scale, and CS, RS, AT, CT, and RT for the study program scale (see Table S5). In all, these S-factors were almost the same as in Study 1. Indeed,

Table 7 Study 2: Independent Prediction of Psychological Distress by Each Provider

Predictor	Mean λ	Reliability (ω)	Predictive paths (β)	
			Anxiety	Depression
Model 1: $\chi^2(602) = 1811.38$, $p < .001$, CFI = 0.980, TLI = 0.974, RMSEA = 0.033, SRMR = 0.028				
T-G-Factor	.62	.96	− .355*	− .399*
T-AS	.28	.43	.154*	.120*
T-AT	.50	.71	− .013	.039
T-CS	.22	.30	− .027	− .050
T-CT	.31	.46	.061	.059
T-RS	.23	.41	.147	.147*
T-RT	.17	.21	− .282*	− .217*
Model 2: $\chi^2(602) = 1571.90$, $p < .001$, CFI = 0.989, TLI = 0.986, RMSEA = 0.031, SRMR = 0.030				
P-G-Factor	.71	.98	− .232*	− .274*
P-AS	.24	.47	− .071	− .029
P-AT	.63	.85	.069*	.129*
P-CS	.16	.29	− .043	− .025
P-CT	.30	.52	.150*	.108*
P-RS	.19	.42	.132*	.137*
P-RT	.38	.71	.128*	.232*
Model 3: $\chi^2(602) = 1771.04$, $p < .001$, CFI = 0.979, TLI = 0.973, RMSEA = 0.036, SRMR = 0.029				
S-G-Factor	.71	.98	− .339*	− .374*
S-AS	.24	.47	− .069*	− .047
S-AT	.63	.85	− .043	.005
S-CS	.16	.29	− .010	− .059
S-CT	.30	.52	.034	.075*
S-RS	.19	.42	− .006	− .010
S-RT	.38	.71	.303*	.275*

Each model has six S-factors and one G-factor; X^2 chi-square test of exact fit; *CFI* comparative fit index; *TLI* tucker-Lewis Index; *RMSEA* root mean square error of approximation; *SRMR* root mean square residual. *T*- teachers; *P*- peers; *S*- study programs; *AS* autonomy support; *AT* autonomy thwarting; *CS* competence support; *CT* competence thwarting; *RS* relatedness support; *RT* relatedness thwarting; *λ* factor loadings; *ω* omega coefficients; *β* standardized coefficients. * $p < .05$

10 out of the initial 11 are replicated (all except teacher RT), and 3 more are added (teacher CT, and peer AS and CT). Table S7 of the online supplementary material presents the final items of each scale.

Prediction of students' psychological distress

We first used the three bifactor-ESEM models previously validated (one for each source) to assess the relevance of each dimension of need-related practices in predicting students' psychological distress (i.e. anxiety and depression). The results from the prediction analyses are presented in Table 7. In terms of predictors, only the factors with omega reliability coefficients above 0.50 were interpreted (Perreira et al., 2018). For the teacher model (Model 1), the G-factor negatively predicted students' anxious (β = -0.355, $p < 0.001$) and depressive symptoms (β = -0.399, $p < 0.001$). No well-defined S-factors were significantly linked to students' psychological distress above the prediction by the G-factor. For the peer model (Model 2), the G-factor was also a negative predictor of students' anxious (β = -0.232, $p < 0.001$) and depressive symptoms (β = -0.274, $p < 0.001$). Moreover, each need thwarting S-factor of that model (i.e. AT, CT, and RT) was well-defined and a positive predictor of students' anxiety and depression (β from 0.069 to 0.232, $ps < 0.05$). Regarding the study program climate model (Model 3), the G-factor was again a negative predictor of students' symptoms of anxiety (β = -0.339, $p < 0.001$) and depression (β = -0.374, $p < 0.001$). Furthermore, CT was a positive predictor of students' depressive symptoms, although the coefficient was small ($\beta = 0.075$, $p = 0.03$). Lastly, RT was a positive predictor of both students' anxious ($\beta = 0.303$, $p < 0.001$) and depressive symptoms ($\beta = 0.275$, $p < 0.001$).

Then, to assess the concurrent contribution of need support and need thwarting from all providers in predicting students' psychological distress, we first estimated three preliminary measurement models. The first and second measurement models encompassed, respectively, need supportive and need thwarting practices from all sources. In both models, three bifactor-ESEM (one for each source) with each one G-factor and three need-specific S-factors were computed. The factors (G-factor and S-factors) representing one source were orthogonal among themselves but free to covary with factors from other sources. In the third measurement model, two CFA factors were computed representing students' anxiety and depression. These three models allowed the estimation of factor scores (estimated in standardized units, $M = 0$, $SD = 1$) to be used in the prediction model (Morin & Marsh, 2015). More precisely, we estimated a model comprising two predictors per source, global levels of need support and global levels of need thwarting (six predictors in total). We used only the G-factors as predictors for the sake of parsimony and simplicity. This model also made it possible to assess the importance of need thwarting relatively to that of need support in predicting students' outcomes.

The results of this prediction model are presented in the bottom section of Table 8 and illustrated in Fig. 2. These results showed that global levels of need support by teachers and relative to study programs negatively predicted students' anxious (β_{Teachers} = -0.097, $p = 0.04$; $\beta_{\text{Study Program}}$ = -0.090, $p = 0.04$) and depressive symptoms (β_{Teachers} = -0.104, $p = 0.02$; $\beta_{\text{Study Program}}$ = -0.091, $p = 0.03$). On the other hand, global levels of need support by peers positively predicted students' depressive symptoms ($\beta = 0.077$, $p = 0.04$). This

Table 8 Study 2: Concurrent Prediction of Psychological Distress by All Providers

Variables	1	2	3	4	5	6	7	8
1. T-GLNS		−.662	.489	−.357	.793	−.582	−.287	−.324
2. T-GLNT			−.386	.562	−.546	.758	.300	.356
3. P-GLNS				−.678	.480	−.317	−.203	−.232
4. P-GLNT					−.340	.446	.281	.329
5. S-GLNS						−.608	−.290	−.321
6. S-GLNT							.329	.370
7. Anxiety	−.097*	−.028	.067	.206*	−.090*	.171*		.864
8. Depression	−.104*	.012	.077*	.236*	−.091*	.168*		

Over the diagonal = R correlations; Under the diagonal = βs predicting psychological distress in the SEM model; *T*- teachers; *P*- peers; *S*- study programs; *GLNS* global levels of need support; *GLNT* global levels of need thwarting. All correlations (above diagonal) are significant at $p < .001$. * $p < .05$ (for βs)

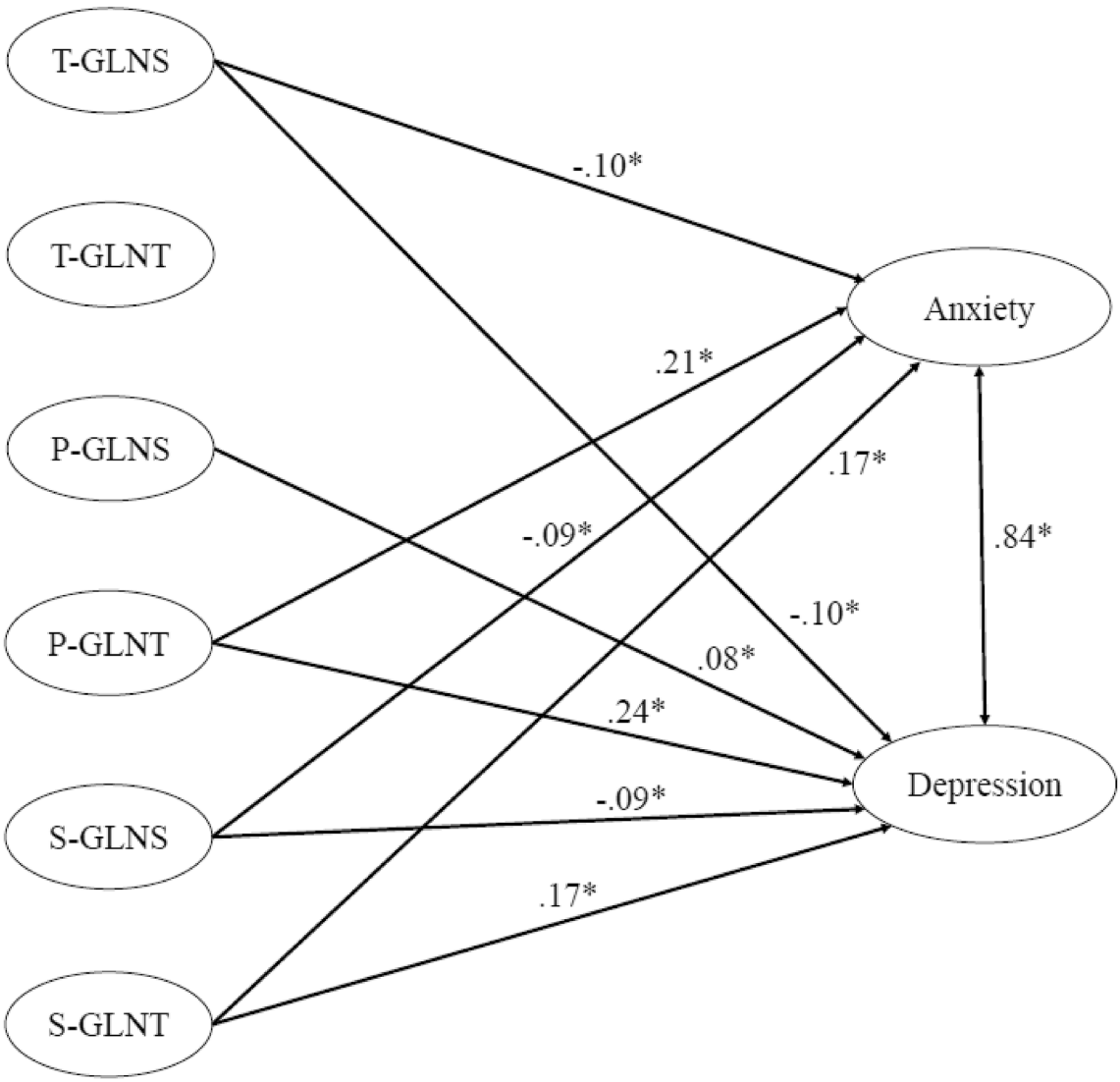

Fig. 2 Prediction of students' psychological distress by global levels of need support/thwarting. Only significant paths are depicted in the figure; Correlations between predictors are not depicted for purpose of simplicity; *T*- Teachers; *P*- Peers; *S*- Study programs; *GLNS* Global levels of need support; *GLNT* Global levels of need thwarting
*$p < .05$

result is surprising considering that these two variables present a negative bivariate correlation (r = -0.232; see the top section of Table 8). It thus appears that a suppression effect was obtained since the relation between these two variables was inverted in the prediction model (Maassen & Bakker, 2001). Therefore, it should not be concluded that global levels of need support by peers undermine students' psychological well-being. Over and above those effects, global levels of need thwarting by peers and in study programs were both positive predictors of students' anxiety ($\beta_{\text{Peers}} = 0.206$, $p < 0.001$; $\beta_{\text{Study Program}} = 0.171$, $p < 0.001$) and depression ($\beta_{\text{Peers}} = 0.231$, $p < 0.001$; $\beta_{\text{Study Program}} = 0.168$, $p < 0.001$). Global levels of need thwarting by teachers were not a significant predictor of students' psychological distress once need-related practices from other sources were taken into account.

Brief discussion

With Study 2, the CNSTQ was refined and validated with another sample of college students. Two items were added to the peer scale (RS and RT subscales) and to the study program scale (AS and AT subscales) so that each final subscale was composed of four items. Our results provided additional support to H1 by showing that each scale had one well-defined G-factor as well as six S-factors with varying degrees of specification.

More importantly, Study 2 tested hypotheses $H3_a$, $H3_b$, and H4. First, $H3_a$ and $H3_b$ were only partially supported. Indeed, when sources were taken separately, global levels of need support/thwarting consistently predicted students' psychological distress while only a few subfactors significantly predicted students' outcomes. Interestingly, these subfactors were all representing need thwarting practices: AT, CT, and RT by peers as well as CT and RT within the study program climate. Our results thus suggest that global levels of need support/thwarting might be more important for predicting students' psychological distress than specific dimensions of need-related practices. However, for peers and study programs, it might still be important to distinguish subdimensions of need thwarting once global levels of need support/thwarting are factored in. Second, our results confirmed H4, showing that the study program climate is important in predicting students' psychological distress over and above teachers' and peers' interpersonal behaviors. Indeed, global levels of need-support relative to study programs negatively predicted students' anxiety and depression while global levels of need thwarting by that source positively predicted these symptoms of psychological distress. Noteworthy, need thwarting by peers stood out as the strongest predictor of students' anxiety and depression. In comparison with the role of teachers, peers and the study program climate are thus identified as contextual predictors of strong relative importance in predicting students' psychological distress. Taken together, all these results point to the importance of need thwarting in understanding the mental health issues faced by many college students.

General discussion

In this research, we aimed to develop reliable tools to study the relations across need support and need thwarting from various sources in the college context and students' psychological distress. More precisely, we developed and validated the CNSTQ which measures college students' perception of need supportive and need thwarting practices provided by their teachers, peers, and study programs. We then assessed the relevance of these practices in predicting students' anxious and depressive symptoms with an emphasis on the concurrent contribution of all providers in predicting these symptoms of psychological distress.

Scale validation

In general, results of Study 1 and Study 2 supported the validity of the CNSTQ. We highlighted the construct validity of the teacher, peer, and study program scales as shown, among others, by adequate CFA and bifactor-ESEM models (H1). With respect to scale structure, our hypothesis was confirmed regarding the six factors of need support and need thwarting (i.e. AS, CS, RS, AT, CT, RT) in each source. Bifactor-ESEM further allowed the estimation of students' perceived global levels of need support/thwarting while still accounting for their perceptions of specific dimensions of need support/thwarting. It also provided a way to assess some degree of theoretically plausible overlap between S-factors, allowing for a more accurate specification of each one of them (Marsh et al., 2014).

Results from bifactor-ESEM models in Studies 1 and 2 revealed that G-factors were all well-defined ($M_\lambda = 0.64$; $M\omega$ = .96). This suggests that within each source, need supportive and need thwarting practices share a common core that reflects commonalities among students' ratings of these practices. In turn, these commonalities highlight the fact that the six dimensions of need-related practices (i.e. three needs, two facets per need) are not totally independent from one another. Assessing these global levels of need support/thwarting is thus necessary to acknowledge the overlap between these dimensions. Moreover, more than half of the S-factors of the CNSTQ (11 and 13 out of 18 in Studies 1 and 2, respectively) retained meaningful residual specificity. This means that specificities within most dimensions of need support and need thwarting are important beyond global levels of support/thwarting. For the teacher scale, AS, RS and AT dimensions were consistently well-defined, indicating

that these dimensions may be important over and above a general need supportive factor. For peers, AT and RT dimensions were consistently well-defined, suggesting that these behaviors may remain impactful even when classmates are generally need supportive. Finally, as pertains to study programs, all dimensions except AS consistently displayed well-defined subfactors. This indicates that need support and thwarting in the study program climate is multidimensional and that future studies evaluating this construct should go beyond a unidimensional investigation. It thus seems that, for teachers and peers, many specific dimensions are relevant only for their contribution to the general factor. This is not the case for the study program scale, where more specific dimensions are caused by one global and multiple subfactors. Such a fine-grained analysis is made possible by the use of bifactor-ESEM. Overall, our results are in line with those of past research (Tóth-Király et al., 2020) by showing that the variance in scores of need-related practices is better represented by a bifactor-ESEM solution.

Study 1 also evaluated whether need-relevant practices from the three sources correlated in theoretically expected directions with students' needs satisfaction and need frustration at school (H2). All associations were consistent in this regard, corroborating the convergent validity of the CNSTQ. Furthermore, these correlations were only moderate in strength (M_r =|.37|, $SD_r = 0.15$), showing that the subjective perceptions of need-relevant practices from teachers, peers, and relative to study programs were distinct from the subjective experience of satisfaction and frustration of those needs, thus supporting the discriminant validity of the CNSTQ.

Prediction of students' psychological distress

Independent contribution from teachers, peers, and study programs

Regarding the relevance of need-related practices by the various providers in predicting students' psychological distress, our results highlighted the importance of providing need support, and avoiding need thwarting, from both teachers and peers, as well as relative to the study program climate (H3). Indeed, global levels of need support/thwarting from the various providers were all significant and negative predictors of students' anxiety and depression, thus supporting SDT postulate regarding the importance of need support for psychological adjustment (Vansteenkiste et al., 2020). However, only a few specific dimensions of need support and need thwarting (i.e. S-factors) across the three scales significantly predicted students' psychological distress, which partly contradicts $H3_a$ and $H3_b$. For the peer scale, each dimension of need thwarting practices were significant predictors of students' symptoms of anxiety and depression. This suggests that being exposed to one or more classmates that are actively need thwarting might bear negative consequences despite perceiving adequate global levels of need support within one's college social network. In other words, the harmful effects of thwarting interactions with one or multiple peers might override the benefits of supportive interactions, a finding observed in past studies on social support (Lepore, 1992). For the study program scale, only CT and RT were well-defined predictors of students' anxiety and/or depression. This suggests that study programs that are unhelpful for students and chaotic in terms of their functioning (CT) and whose high workload prevents students from maintaining an active social life (RT), represent an important risk factor for students' mental health. These two dimensions are even more important considering that they predict students' psychological distress even if the program is perceived as globally need supportive. These results are in line with those of past studies showing that high academic demands and insufficient resources or help will predict college students' psychological distress (Barker et al., 2018; Mokgele & Rothmann, 2014).

Surprisingly, some well-defined S-factors were not significant predictors of students' anxiety and depression. This was the case for the AT dimension of both the teacher and study program scales. These findings suggest that variations in AT beyond global need support/thwarting levels in these two sources may not be important enough to further predict students' psychological distress. In other words, once global levels of need support/thwarting are factored in, students' perceptions of AT by their teachers and study program might bear minimal consequences for their psychological adjustment. Additionally, CT by study programs predicted students' symptoms of depression but not those of anxiety. This highlights the fact that although anxiety and depression fall under a similar conceptual umbrella (i.e. psychological distress; Drapeau et al., 2012), they can each be differently impacted by the environment (Cummings et al., 2014). In the present case, students tend to feel more depressed (but not more anxious) when they do not perceive that their study program is supporting them when needed, and when important information affecting their progress is not communicated to them.

Concurrent contribution from teachers, peers, and study programs

As for the concurrent contribution from all providers, our results showed that global levels of need thwarting emitted by peers and relative to the study program climate were the strongest predictors of students' anxious and depressive symptoms. In terms of need support, global levels emitted by teachers and relative to the study program climate negatively predicted students' anxiety and depression, but the effects were rather small ($\beta \leq 0.10$). Overall, these results mostly

support H4 by showing that need-relevant circumstances in study programs are important predictors of students' outcomes beyond the role of other sources. These circumstances in which students evolve on a day-to-day basis might be of particular importance for their psychological adjustment because of their all-encompassing and stable nature. Indeed, students might be exposed to many different teachers and peers during their journey at college, each of which may vary in their proneness to be need supportive or need thwarting, but they are exposed to the same curricular orientations until they reach the end of their studies or change program. This long-lasting nature of need-related practices inherent to study programs might thus result in positive or negative consequences in students' psychological adjustment that go beyond practices emitted by other sources.

Interestingly, our results also highlighted the importance of need thwarting by peers in the prediction of students' psychological distress. In fact, global levels of need thwarting emitted by peers were the strongest predictors of students' anxiety and depression after controlling for the contribution of teachers and study programs. Such results could be explained by the fact that participants of Study 2 were all first-year students, as past research has shown that adjustment to college was related to the quality of the relationships' students have with their college peers during their first year of study (Maunder, 2018). The findings of this study also confirm the results of previous research that highlighted the central importance of peers in students' experience and psychological adjustment to college (Alsubaie et al., 2019; Ratelle et al., 2013).

Lastly, our results showed that, when simultaneously considering global levels of need support and thwarting from all sources, global levels of need thwarting by teachers were not related to students' anxiety and depression and global levels of need support by peers were not linked to students' anxiety (a suppression effect was observed for depression). These results put to light the fact that need-related practices emitted by the various sources overlap in their prediction of depression and anxiety, and some do not stand out as important when other sources are considered. In our view, this does not mean that need thwarting by teachers and need support by peers are irrelevant, but rather that these practices may not represent the main factors explaining college students' psychological distress when several facets of the college context are taken into account. More research is needed in that sense to further expand our comprehension of how need-related practices emitted by teachers, peers, and study programs interact with students' psychological distress.

Implications for research

The main implications of our results for future research are both substantive and methodological. This study is the first to assess need supportive and need thwarting practices emitted by three distinct sources within the college context, including one that is inherent to the educational experience in general rather than focused on a specific social agent. By doing so, it highlights the pertinence of considering many facets of students' experience when predicting their anxiety and depression levels. Indeed, no agent by itself was the best at predicting students' psychological distress, nor was a specific dimension of need-related practices. In fact, all items in all scales contributed strongly to their respective G-factor, which suggests that every subdimension is a meaningful component of the CNSTQ as well as an important element to understand the determinants of students' psychological distress. However, previous research has often relied solely on autonomy support to study the influence of need support on college students' mental health (e.g. Ratelle et al., 2013; Sheldon & Krieger, 2007), overlooking need thwarting practices as well as practices related to the needs for competence and relatedness. The development of the CNSTQ will allow for rigorous investigations of more complete pictures of the college context in future research, possibly reducing the omissions that regularly occur in this field of research. Moreover, the present results also show that scales and subscales from each source are constructed well enough to be used on their own.

Next, this study provided further evidence on the adequacy of the bifactor-ESEM framework for estimating measures of need-related practices. Relying on this framework offers further possibilities on the assessment of global and specific levels of need support and need thwarting and their associations with student outcomes. Bifactor-ESEM models could also help identify which dimensions of need-related practices would need improvement in the field, perhaps because of their strong prediction of students' academic outcomes (e.g. motivation, achievement, perseverance).

Lastly, by highlighting multiple associations between need-thwarting practices and students' anxiety and depression, this research provides further support for the postulate that dark aspects of a life context can promote symptoms of psychopathology (Vansteenkiste & Ryan, 2013). This further highlights how SDT can be used not only to understand the contextual factors that help people thrive but also the ones that promote ill-being. Including measures of need thwarting within future research on college students' psychological adjustment is essential to properly assess the differentiated facets of the college context as proposed by the dual-process model within SDT (Jang et al., 2016).

Implications for practice

Many important implications for educational institutions also emerge from our results. While need support from the various sources might be beneficial for students in many

ways, it does not seem to contribute as significantly as need thwarting in the prediction of their psychological distress. Avoiding need thwarting practices thus seems like the most proficient route in this regard. Therefore, faculties, provosts, as well as teaching and learning centres may have an important leverage to help reduce students' psychological distress by operating meaningful organizational and curricular changes that embrace need support and stray away from need thwarting climate in study programs. For example, emphasis should be placed on designing clear and coherent curriculums in which students have opportunities to make choices and where they are given a voice during curriculum revision processes (Bovill & Bulley, 2011). Information about programs and about possible progression paths should also be made clear and adapted support measures should be offered to students (e.g. by students' services).

One important finding of our study pertains to the impact of study programs' workload (i.e. the RT subscale) on students' anxiety and depression. During program reforms, faculty members are often tempted to "enrich" the program in order to keep pace with evolving disciplinary knowledge (Sansgiry et al., 2006), or to meet new requirements from accreditation bodies (Scully & Kerr, 2014). In addition to being associated with psychological distress in this study, high academic demands were associated with surface learning strategies by students in past research (Parkinson's et al., 2006). Therefore, aspects inherent to study programs workload should be particularly weighed in relation to their administratively perceived pedagogical value during program evaluation processes and curriculum design operations.

Limitations and future directions

The findings from this study should be interpreted in light of certain limitations. First, in both studies, students' perception of need supportive and need thwarting practices, their levels of need satisfaction and need frustration as well as their symptoms of anxiety and depression were all measured at the same time. Therefore, it is not clear whether need supportive and need thwarting practices influenced students' outcomes or if their psychological state shaped their perception of the environment. As such, it would be important that future research assess the relations between these variables within the confines of a longitudinal study. Another limitation is that the scales developed in this study focused solely on students' perceptions. In our view, these scales should be used in conjunction with other tools such as teacher and peer reports of their own practices. However, this would imply moving the framework from a general (all my teachers/ peers) to a specific one (a significant teacher/ peer). Furthermore, objective evaluation of study program climate is definitely possible, and should be investigated.

Conclusion

Psychological distress in college students is a growing contemporary concern. This study developed the tools to investigate the importance of psychological need support and thwarting from teachers, peers, as well as relative to the study program climate in predicting students' psychological distress. While all need-relevant practices from all sources are associated with anxiety and depression, a pooled investigation particularly highlights the importance of need thwarting by peers and relative to the study program climate in predicting anxiety and depression in students. Future research with the CNSTQ should investigate longitudinal prediction of student outcomes and identify which source is the most relevant for predicting various aspects of students' educational experience.

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Data availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Conflict of interest The authors have no conflicts of interest to declare that are relevant to the content of this article.

Ethical approval The questionnaire and methodology for this study were approved by the Human Research Ethics Committee from the institution of the first author (ethics approval number: 2018–323 A-4/16–10-2019).

Consent to participate Informed consent was obtained from all individual participants included in the study.

Consent for publication Participants provided informed consent for the data to be used for research purposes. Moreover, participation in this research project was completely anonymous.

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