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Examinations of basic psychological need satisfaction and frustration profiles and their associations with regulatory focus, resilience, and friendship quality in two samples of students from the Pacific region

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Abstract

To map the complex associations of key antecedents of motivation, this research examined configurations (i.e., profiles) of basic psychological need satisfaction and frustration (of autonomy, competence, and relatedness) in two independent samples of undergraduate students attending universities from two locations in the Pacific region—New Zealand ($N=385$) and Hawai‘i, USA ($N=386$). Latent profile analyses identified seven profiles in each sample. Of these profiles, in both samples, a high satisfaction and low frustration profile captured the most adaptive pattern of need satisfaction and frustration dimensions and was associated with high/very high levels of eagerness, resilience, and friendship quality factors. In contrast, a low satisfaction and high frustration profile exhibited the most maladaptive combination of need satisfaction and frustration dimensions and had the lowest levels of eagerness and resilience and lower levels of friendship quality than most other profiles. In addition, a profile having low/below average satisfaction and above average/high frustration generally had the poorest friendship quality. These findings provide new and valuable insights into the complex associations of basic psychological needs and into how interrelationships among need satisfaction and frustration dimensions underpin individual differences in eagerness, resilience, and friendship quality. Moreover, they have important educational implications, which are explored in the paper.

Keywords Basic psychological needs · Need satisfaction and frustration profiles · Promotion · Prevention · Resilience · Friendship quality · University students

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1 Introduction

The process of learning and teaching is critical for student achievement and well-being. Educational contexts often involve significant interpersonal interactions between teachers and students as well as among students. These interpersonal interactions are among the important factors that influence the extent to which key nutrients required for adaptive functioning (i.e., basic psychological needs; Ryan & Deci, 2017; Vansteenkiste et al., 2023) are supported or thwarted (Slemp et al., 2024; Zeng, 2022). Need satisfaction/frustration, motivation, well-being (e.g., resilience), and interpersonal relationships (e.g., friendship) significantly shape student outcomes in learning settings (Ang et al., 2022; Buote et al., 2007; Vansteenkiste et al., 2020). These factors are not only important on their own, but also likely interact in meaningful ways. For example, interpersonal relationships provide a context for need fulfillment, which in turn influences motivational processes (e.g., internalization; self-regulation) and well-being (Ryan & Deci, 2017). This knowledge notwithstanding, the interrelationships among these factors are yet to be fully mapped and require more research (Ang et al., 2022; Juvonen et al., 2022; Müller et al., 2021).

To bridge this knowledge gap, the present study uses the framework of self-determination theory (SDT; Ryan & Deci, 2017) to examine the links among need satisfaction/frustration and factors supporting student learning and well-being. Specifically, this research (i) provides a parsimonious account of the complex interrelationships among need satisfaction and frustration dimensions (i.e., autonomy, competence, and relatedness) for two populations of undergraduate students from New Zealand and Hawai‘i and (ii) examines the extent to which different types of combinations of need satisfaction and frustration dimensions (i.e., different profiles) are associated with significant differences in motivation, resilience, and friendship quality. We investigated these three kinds of criteria in conjunction with need satisfaction and frustration to help clarify how key constructs couched in different motivational frameworks (i.e., SDT and regulatory focus theory) relate to one another and advance understanding of the roles that need satisfaction and frustration play in self-regulation and interpersonal processes (i.e., resilience and friendship quality). In so doing, the research sheds fresh light on the interrelationships among key factors underpinning adaptive (vs. maladaptive) functioning and informs educational research and practice. Of note, no study we are aware of explored profiles of basic need satisfaction and frustration for samples located in these areas of the Pacific region. Hence, our research also expands the global reach of the need satisfaction/frustration literature and enables in-depth comparisons of patterns of need satisfaction/frustration (and their motivation, resilience, and friendship correlates) between samples drawn from different countries within this region.

2 Literature review

2.1 Basic psychological needs theory

SDT's basic psychological needs theory, which has contributed valuable insights into motivation and well-being, posits that people have three basic psychological needs, and these needs are essential for human flourishing (Ryan & Deci, 2017). These basic psychological needs are autonomy (control and volition over actions), competence (effectiveness in one's environment), and relatedness (connections to and meaningful relationships with others) (Ryan & Deci, 2017).

Basic psychological need satisfaction (BPNS), the degree to which one's needs are met, is associated with a myriad of positive outcomes such as well-being, stronger motivation, and relationship satisfaction (Chen et al., 2015; Patrick et al., 2007; Warburton et al., 2020). In contrast, basic psychological need frustration (BPNF), the extent needs are threatened or impeded (Chen et al., 2015), is associated with stronger detrimental effects than simply the absence of need satisfaction (e.g., ill-being, maladjustment, and amotivation; Chen et al., 2015; Vansteenkiste et al., 2020). Of note, high need satisfaction does not necessarily imply low need frustration and vice versa (Warburton et al., 2020).

Autonomy is the extent to which a person feels volition in their actions (Ryan & Deci, 2017). When autonomy is satisfied, one acts and lives in a way that feels authentic and congruent with one's values (Vansteenkiste et al., 2020). When autonomy is frustrated, individuals feel controlled and forced to engage in actions that are incongruent with their needs, desires, and values (Vansteenkiste et al., 2020). Competence involves a sense of effectiveness and mastery (Ryan & Deci, 2020; Vansteenkiste et al., 2020). When competence is fulfilled, one feels they have the potential to improve and achieve success (Ryan & Deci, 2020). When competence is frustrated, one may experience feelings of failure and inadequacy (Vansteenkiste et al., 2020). Relatedness concerns one's connection to others and sense of belonging (Ryan & Deci, 2020; Vansteenkiste et al., 2020). When relatedness is fulfilled, people feel unconditionally accepted, significant, valued, and cared for by others. When relatedness is frustrated, individuals feel isolated, excluded, and lonely (Chen et al., 2015).

Recent work has begun to explore the complex associations among basic psychological need satisfaction and frustration (BPNS&F) dimensions by analyzing BPNS&F profiles; these profiles reflect distinct configurations of autonomy satisfaction, autonomy frustration, competence satisfaction, competence frustration, relatedness satisfaction, and relatedness frustration (e.g., Gilbert et al., 2023; Li et al., 2020; Reed-Fitzke & Lucier-Greer, 2020; Rouse et al., 2019; Warburton et al., 2020). In this literature, four studies defined BPNS&F profiles based on all the six need satisfaction and frustration dimensions and collected data from samples of university students (as it was also the case in our research). The main findings of these studies, which are summarized in Table 1, indicate that although existing research uncovered a range of profiles, only two of these profiles were identified in all studies. Hence, it is important to assess whether additional profiles (beside these two) are common across samples.

Identifying generalizable need satisfaction-frustration profiles is critical because contextual affordances and constraints in learning environments, such as teaching

Table 1 BPNS&F profiles identified in previous studies with profile descriptions and percentage of participants classified in each profile

Study	Sample size	Country	Profiles (% of participants and profile descriptions)
Gilbert et al. (2023)	1053	Canada	Profile 1 (25%) high satisfaction of all needs, low frustration of all needs Profile 2 (30%) low satisfaction of all needs, high frustration of all needs Profile 3 (45%) average satisfaction of all needs, average frustration of all needs
Li et al. (2020)	491	China	Profile 1 (9%) high satisfaction of all needs, low frustration of all needs Profile 2 (43%) low satisfaction of all needs, high frustration of all needs Profile 3 (43%) average satisfaction of all needs, average frustration of all needs Profile 4 (5%) high satisfaction of all needs, high frustration of all needs
Li et al. (2022)	928	China	Profile 1 (37%) high satisfaction of all needs, low frustration of all needs Profile 2 (19%) low satisfaction of all needs, high frustration of all needs Profile 3 (44%) average satisfaction of all needs, average frustration of all needs
Reed-Fitzke and Lucier-Greer (2020)	452	Unspecified	Profile 1 (54%) high satisfaction of all needs, low frustration of all needs Profile 2 (46%) low satisfaction of all needs, high frustration of all needs

AS autonomy satisfaction, *AF* autonomy frustration, *CS* competence satisfaction, *CF* competence frustration, *RS* relatedness satisfaction, *RF* relatedness frustration

style and the nature of feedback, significantly influence satisfaction and frustration of basic needs (Ahmadi et al., 2023; Ryan & Deci, 2017). In addition, basic needs could be altered by both initiatives that focus on the individual (e.g., Moe, 2022; van den Bogaard et al., 2025) and by interventions that target the context of learning and teaching (e.g., teachers' behaviors; Ahmadi et al., 2023). Therefore, knowledge of generalizable profiles, which highlights the specific characteristics of profiles (i.e., the combinations of needs) that are common across samples, could help enhance the efficiency of interventions that support learning and well-being by means of altering (parts of) students' BPNS&F profiles.

In addition to identifying need satisfaction/frustration profiles that generalize across the two samples, this study aims to strengthen understanding of how the interactions among the BPNS&F dimensions relate to other factors influencing student learning and well-being. Examining this aspect enables uncovering combinations of need satisfaction and frustration dimensions (i.e., profiles) that are potentially adaptive—as well as combinations/profiles that are potentially maladaptive—with regard to key motivation, resilience, and friendship factors. The following sections overview the factors we investigated in relation to the BPNS&F profiles and highlight their relationships with BPNS&F.

2.2 Regulatory focus theory

Regulatory focus theory describes two motivation orientations that influence goal pursuit—promotion and prevention (Scholer et al., 2019); details follow. Vaughn's (2017) need-support model proposes that regulatory focus and satisfaction of basic psychological needs influence each other. For example, when individuals' needs are supported, they construe many of their experiences as opportunities to advance/progress (i.e., exhibit a promotion focus). When people lack support for their needs, they prioritize avoiding negative outcomes and maintaining what they already have (i.e., exhibit a prevention focus) (Vaughn, 2017). Although existing research has provided some support for the positive associations between need satisfaction and promotion, the findings regarding prevention are mixed and difficult to interpret (Aubert et al., 2022; Hodis & Hodis, 2021; Vaughn, 2017; Vaughn et al., 2020). What is more, few existing studies investigated whether need frustration is associated with regulatory focus; see Hodis and Hodis (2021) as an exception. The present study aims to overcome these important limitations and provide a more nuanced understanding of how the interactions among need satisfaction and frustration dimensions (i.e., the BPNS&F profiles) relate to promotion and prevention.

Promotion and prevention orientations focus on different goals and are associated with preference for different types of strategies (Vriend et al., 2022). Promotion, which is driven by growth and achievement goals (Molden & Rosenzweig, 2016), reflects the extent an individual is motivated by gains and strives for improvement and accomplishment (Scholer et al., 2019). People who have a strong promotion orientation prefer to use eager strategies, which prioritize gains/progress, and involve exploring large sets of alternatives, favoring speed over accuracy, and being open to change (Scholer et al., 2019). Prevention is driven by safety and security goals (Molden & Rosenzweig, 2016). A prevention orientation subsumes the degree a person is motivated by non-losses (successful avoidance of negative outcomes) and is associated with seeking safety and fulfilling one's responsibilities (Molden & Rosenzweig, 2016). People who have a strong prevention orientation prefer to employ vigilant strategies, which prioritize avoiding mistakes, maintaining security, and upholding duties and obligations (Scholer et al., 2019).

2.3 Resilience

Resilience is "the ability to bend but not break, bounce back, and perhaps even grow in the face of adverse life experiences" (Southwick et al., 2014, p. 2). Although resilience is a key aspect of effective self-regulation and well-being, the factors/mechanisms underpinning high (vs. low) levels of resilience are not well understood and require further research (Brewer et al., 2019; Sisto et al., 2019; Southwick et al., 2014). As we discuss below, research evidence suggests that satisfaction/frustration of basic needs may be critical factors shaping resilience.

Resilience is meaningfully linked to need satisfaction/frustration because having high satisfaction and low frustration of basic needs enables people who experience significant stressors or challenges to maintain a relatively adaptive psychological outlook (e.g., by restricting how much they are concerned about the impact of the given

stressors/challenges) (Waterschoot et al., 2024) and, thus, be more resilient. Consistent with this viewpoint, previous research found positive associations between resilience and each need satisfaction dimension; this was the case in several different cultures (e.g., Canada—Neufeld & Malin, 2019 and Neufeld et al., 2020; China—Xu et al., 2021; Myanmar—Thein & Phyoe, 2017). In contrast, the few studies that examined resilience in conjunction with the need frustration dimensions found negative associations for each dimension (e.g., Neufeld & Malin, 2019 and Neufeld et al., 2020). These important findings notwithstanding, it is currently unclear how constellations (profiles) of need satisfaction and frustration dimensions relate to the levels of students' resilience. This limitation has important conceptual and educational implications. For example, it is not well understood whether having high levels of resilience requires all dimensions of need satisfaction to be strong (and all dimensions of need frustration to be weak). Our research aims to shed fresh lights on these aspects.

2.4 Friendship

Friendships are voluntary and interdependent relationships marked by "intimacy, equality, shared interests, and pleasurable or need satisfying interactions" (Blieszner & Roberto, 2003, p. 159). A relationship involves two or more people whose behaviors influence one another over time (Madsen & Collins, 2006). Relationships motivation theory, a sub-theory of self-determination theory, proposes that satisfaction and frustration of psychological needs experienced within close relationships shape the quality of these relationships (Ryan & Deci, 2017). Of note, much of the existing literature on interpersonal relationships and need fulfillment has primarily focused on hierarchical relationships (e.g., teacher-student), prompting some scholars to call for greater attention to peer relationships, such as friendships (Slemp et al., 2024).

Examining the associations between friendship and need satisfaction/frustration is important because the contribution of friendship and other peer relationships to fostering need fulfillment is distinct from, and adds to, support from hierarchical relationships (Slemp et al., 2024). Consistent with this viewpoint, some researchers have highlighted friendships as an underutilized support source for psychological need supportive interventions and strategies aimed at increasing student motivation and resilience (Frisby et al., 2020; Slemp et al., 2024). To map how the interactions among need satisfaction and frustration dimensions relate to friendship, the present research examines similarities and differences among BPNS&F profiles with regard to several factors underpinning friendship quality for university students. Such an investigation facilitates understanding the extent to which interactions among autonomy, competence, and relatedness satisfaction/frustration contribute to the quality of friendship. Following, we briefly overview research findings suggesting that friendship quality is meaningfully associated with satisfaction and frustration of basic psychological needs.

Friendships are pivotal for university students as they can act as significant sources of support and enhance psychological well-being (Buote et al., 2007; Maunder, 2018). Need satisfaction/frustration dimensions likely interplay with how individuals experience and evaluate their friendships (Deci et al., 2006; Demir & Davidson, 2012). For example, Deci and colleagues (2006) found that giving autonomy support

to a friend and receiving autonomy support from a friend were positively associated with need satisfaction and friendship quality.

Several studies examined the associations among need satisfaction/frustration and friendship quality factors. For example, in a sample of US university students, Demir and Özdemir (2010) found a strong positive association between an overall measure of need satisfaction and a composite friendship quality measure (which included, among other facets, companionship, intimacy, and emotional security). Similarly, for a sample of adolescents from Indonesia, Putri and Muttaqin (2022) reported positive associations between friendship quality and each of the three need satisfaction dimensions (i.e., autonomy, competence, and relatedness). In a study that surveyed college students from Iran, Reshvanloo et al. (2023) found that for all basic psychological need dimensions, engaging with friends in need-supportive ways (which included both giving and receiving need support) was associated with higher friendship quality. In contrast, engaging with friends in need thwarting ways was related to lower friendship quality (i.e., lower vitality, satisfaction, commitment, intimacy, trust, and empathy). In a similar vein, meta-analytic findings reported by Slemp and colleagues (2024) show that need supportive behaviors enacted in the context of interpersonal relationships (e.g., with teachers and peers in school settings) were positively related to satisfaction—and negatively related to frustration—of each basic psychological need. In some cases, the associations were stronger within peer relationships than within relationships involving students and teachers, highlighting that high quality friendships are likely to support need fulfillment (Slemp et al., 2024).

3 The current study: hypotheses and research questions

Our survey of the relevant literature indicates that it is currently unclear how many (and what types of) profiles underpin the associations among the six need satisfaction and frustration dimensions (research question 1; RQ1). To address RQ1, we used mixture modeling (Harring & Hodis, 2016) to find the number and types of BPNS&F profiles that can be identified in two independent samples of undergraduate students enrolled at institutions from two locations in the Pacific region—New Zealand (NZ) and Hawai‘i, USA (HI). An additional research question (RQ2) we explored was: Are the BPNS&F profiles identified similar or different in the NZ and HI student populations?

Our work also investigated how the complex associations among the six need satisfaction and frustration dimensions that define the BPNS&F profiles relate to regulatory focus orientations (i.e., eager and vigilant strategies), resilience, and friendship quality factors. Considering that the majority of studies that assessed the associations between BPNS&F dimensions, on the one hand, and regulatory focus, resilience, and friendship, on the other hand, used variable-centered data analytic techniques (e.g., zero-order correlations; multiple regressions), the current literature has provided limited information on how subsamples corresponding to different profiles are similar or different with regard to eager/vigilant strategies, resilience, and friendship quality factors.

These limitations of the current knowledge notwithstanding, it is possible to propose three hypotheses. The first hypothesis, (H1) is that profiles characterized by high satisfaction and low frustration of all dimensions are likely to be associated with high eagerness, high resilience, and high friendship quality. The second (H2) is that profiles that have low satisfaction and high frustration of all needs are likely to exhibit low levels of eagerness, resilience, and friendship quality. The third hypothesis (H3) is that profiles having high levels of relatedness satisfaction and low levels of relatedness frustration are likely to be associated with strong friendship quality as long as the remaining needs are at least somewhat satisfied and not highly frustrated.

4 Methods

4.1 Sample and procedure

This study received ethics approval from Victoria University of Wellington's Human Ethics Committee (Reference # 0000030199). Participants were recruited from universities and colleges across NZ and HI over a five-month period from June to October 2022. Participation in the survey was voluntary and anonymous. Instructors, staff, and student organizations from tertiary institutions were contacted by the first author through email to help recruit eligible participants. The survey was delivered through Qualtrics, an online survey platform. Participants accessed the survey via a web link or a QR code. Once they opened the survey, students had one week to finish it before the session closed and their responses were recorded. Except for the eligibility items (i.e., being at least 18 years old and being enrolled as an undergraduate student at a college or university located in NZ or HI), any question could be skipped. Data collection ended once two weeks passed in which no new surveys attempts were made.

The participants in this study were 771 undergraduate students. Of these, 385 attended a NZ university and 386 were enrolled in a HI university. Demographic information on each sample, which is reported in Table 2, suggests that, on average, the HI sample was younger than the NZ sample. Nonetheless, the other demographic characteristics were comparable between the two samples.

Table 2 Demographic information for both samples

Variable	New Zealand sample	Hawai'i sample
Mean age and confidence interval for age	24.6 ± 9.2 years	21.5 ± 5.9 years
Percentage female	71.2%	66.1%
Percentage male	22.1%	30.8%
Percentage of participants who identified as Māori, Native Hawaiian, Pasifika, or Pacific Islander	21.6%	23.3%

4.2 Instruments

The survey used to collect data comprised 71 items that evaluated participant eligibility (2 items), demographic information (4 items), BPNS&F (24 items), eager/vigilant strategies (6 items), relationship quality with a significant friend (29 items), and resilience (6 items). The four demographic questions consisted of university location (i.e., NZ, HI), age, gender, and identification as Māori, Native Hawaiian, Pasifika, or Pacific Islander. Information on the scales used in this study is provided below; Cronbach's alpha reliabilities are reported in Table 3 (for the NZ sample) and Table 4 (for the HI sample).

4.2.1 Basic psychological need satisfaction and frustration scale

The Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS) was used to measure BPNS&F for autonomy, relatedness, and competence (Chen et al., 2015). This scale has been heavily used in research focusing on need satisfaction/frustration and, in most cases, has been found to have good/acceptable psychometric properties (e.g., Grubbs et al., 2025; but see Murphy et al., 2023 for an exception). The BPNSFS scale consisted of 24-items, each evaluated on a 7-point Likert scale (1 = strongly disagree, 4 = neutral, and 7 = strongly agree).

The BPNSFS measured six dimensions—*autonomy satisfaction* (e.g., "I feel a sense of choice and freedom in the things I undertake"), *autonomy frustration* (e.g., "Most of the things I do feel like 'I have to'"), *relatedness satisfaction* (e.g., "I feel connected with people who care for me, and for whom I care"), *relatedness frustration* (e.g., "I feel excluded from the group I want to belong to"), *competence satisfaction* (e.g., "I feel capable at what I do"), and *competence frustration* (e.g., "I feel insecure about my abilities"). Each dimension was measured using four items.

4.2.2 Regulatory goals and strategies questionnaire

Six items from the Regulatory Goals and Strategies Questionnaire (RGSQ) were used to assess promotion-and prevention-related strategies (Vriend et al., 2022). Promotion was assessed in terms of *eager strategies* and was gauged with three items (e.g., "In life, to attain my goals, I enthusiastically embrace all opportunities"). Prevention was assessed in terms of *vigilant strategies* and was measured with three items (e.g., "In life, to attain my goals, I am concerned with making mistakes"). All items were rated on a 7-point Likert scale (1 = strongly disagree, 4 = neutral, and 7 = strongly agree).

4.2.3 Social network questionnaire

The Social Network Questionnaire was used to measure participants' relationship quality with a significant friend (Neyer & Asendorpf, 2001; Parker et al., 2012). Participants were requested to recall a friend (non-romantic peer) who played an important role in their life, either positive or negative, and with whom they had contact at least once during the past three months. Respondents were asked to rate their friend-

Table 3 Descriptive statistics and correlations for the New Zealand sample

	Mean	Variance	Cronbach's alpha	Correlations					
				AS	AF	CS	CF	RS	RF
Basic psychological need satisfaction and frustration									
AS (4 items)	5.023	1.141	0.785	1.00	–	–	–	–	–
AF (4 items)	4.138	1.620	0.773	− 0.502	1.00	–	–	–	–
CS (4 items)	4.895	1.455	0.866	0.511	− 0.335	1.00	–	–	–
CF (4 items)	4.417	2.328	0.841	− 0.383	0.509	− 0.693	1.00	–	–
RS (4 items)	5.588	1.083	0.787	0.378	− 0.346	0.363	− 0.402	1.00	–
RF (4 items)	3.063	1.859	0.815	− 0.345	0.460	− 0.367	0.573	− 0.656	1.00
Regulatory goals and strategies questionnaire									
Eagerness strategies (3 items)	4.773	1.283	0.741	0.405	− 0.223	0.519	− 0.354	0.239	− 0.195
Vigilant strategies (3 items)	4.810	1.478	0.694	− 0.183	0.320	− 0.192	0.436	− 0.159	0.290
Brief resilience scale									
Resilience (6 items)	3.900	1.768	0.898	0.359	− 0.417	0.472	− 0.599	0.273	− 0.391
Social network questionnaire									
Friendship quality (5 items)	5.797	0.770	0.570	0.088	− 0.179	0.147	− 0.199	0.320	− 0.340
Network of relationships inventory									
Seeks safe haven (3 items)	2.687	1.356	0.928	0.015	− 0.074	0.082	− 0.091	0.257	− 0.203
Seeks secure base (3 items)	3.410	1.092	0.870	0.161	− 0.150	0.151	− 0.150	0.336	− 0.281
Provides safe haven (3 items)	2.663	1.262	0.936	0.065	− 0.018	0.072	− 0.056	0.221	− 0.168
Provides secure base (3 items)	3.660	0.874	0.813	0.166	− 0.104	0.056	− 0.006	0.225	− 0.179
Companionship (3 items)	2.838	1.026	0.846	0.078	− 0.079	0.081	− 0.047	0.260	− 0.195
Negative interactions (9 items)	1.371	0.267	0.877	− 0.054	0.108	0.046	0.034	− 0.034	0.105

AS autonomy satisfaction, *AF* autonomy frustration, *CS* competence satisfaction, *CF* competence frustration, *RS* relatedness satisfaction, *RF* relatedness frustration

Table 4 Descriptive statistics and correlations for the Hawai'i sample

	Mean	Variance	Cronbach's alpha	Correlations					
				AS	AF	CS	CF	RS	RF
Basic psychological need satisfaction and frustration									
AS (4 items)	5.057	0.954	0.717	1.00	–	–	–	–	–
AF (4 items)	4.191	1.749	0.796	− 0.485	1.00	–	–	–	–
CS (4 items)	5.099	1.110	0.819	0.603	− 0.395	1.00	–	–	–
CF (4 items)	4.176	2.206	0.865	− 0.470	0.629	− 0.674	1.00	–	–
RS (4 items)	5.678	0.998	0.794	0.484	− 0.284	0.423	− 0.346	1.00	
RF (4 items)	2.925	1.625	0.769	− 0.393	0.436	− 0.437	0.528	− 0.631	1.00
Regulatory goals and strategies questionnaire									
Eagerness strategies (3 items)	5.061	1.277	0.800	0.527	− 0.258	0.537	− 0.368	0.365	-0.306
Vigilant strategies (3 items)	5.075	1.115	0.576	− 0.113	0.321	− 0.171	0.408	− 0.085	0.187
Brief resilience scale									
Resilience (6 items)	4.036	1.301	0.859	0.313	− 0.414	0.468	− 0.569	0.200	-0.319
Social network questionnaire									
Friendship quality (5 items)	5.748	1.011	0.723	0.158	− 0.171	0.175	− 0.167	0.309	-0.360
Network of relationships inventory									
Seeks safe haven (3 items)	3.040	1.414	0.915	0.012	− 0.020	0.063	− 0.028	0.216	− 0.126
Seeks secure base (3 items)	3.603	1.055	0.824	0.125	− 0.104	0.172	− 0.087	0.300	− 0.237
Provides safe haven (3 items)	2.998	1.395	0.929	− 0.015	0.005	0.101	− 0.070	0.232	− 0.217
Provides secure base (3 items)	3.722	0.909	0.824	0.093	− 0.027	0.127	− 0.025	0.225	− 0.175
Companionship (3 items)	3.247	0.995	0.811	0.073	− 0.024	0.076	− 0.032	0.232	− 0.171
Negative interactions (9 items)	1.488	0.372	0.904	− 0.116	0.182	− 0.039	0.107	− 0.149	0.199

AS autonomy satisfaction, *AF* autonomy frustration, *CS* competence satisfaction, *CF* competence frustration, *RS* relatedness satisfaction, *RF* relatedness frustration

ship with their friend in regard to five items—*contact* (i.e., "I am often in contact with this person"), *importance* (i.e., "This relationship is important to me"), *closeness* (i.e., "I feel close to this person."), *conflict* (i.e., "I often have conflicts with this person"), and *insecurity* (i.e., "I often feel insecure with this person's presence"). Each item used a 7-point Likert scale (1 = strongly disagree, 4 = neutral, and 7 = strongly agree).

4.2.4 The network of relationships inventory: behavioral systems version

The Network of Relationships Inventory: Behavioral Systems Version (NRI-BSV) was also used to assess other aspects of the relationship quality with a friend (Furman & Buhrmester, 2009). Participants were asked to recall a friend (non-romantic peer) who played an important role in their life, either positive or negative, and with whom they had contact at least once during the past three months. They rated the friendship quality on 24 items using a 5-point Likert scale (1 = little or none, 2 = somewhat, 3 = very much, 4 = extremely much, and 5 = the most).

The NRI-BSV assessed relationship quality using five support scales and three negative interaction scales. Each scale was comprised of three items. The support scales measured the degree the participant *seeks out their friend as a safe haven* (e.g., " How much do you seek out this person when you're upset?"), *seeks out their friend as a secure base* (e.g., " How much does this person encourage you to try new things that you'd like to do but are nervous about?"), *provides a safe haven for their friend* (e.g., "How much does this person turn to you for comfort and support when this person is troubled about something?"), *provides a secure base for their friend* (e.g., "How much do you show support for this person's activities?"), and *companionship* (e.g., "How often do you and this person go places and do enjoyable things together?"). The negative interaction scales measured participants' *perceived conflict* (e.g., "How much do you and this person get upset with or mad at each other?"), *criticism* (e.g., "How much do you and this person criticize each other?"), and *antagonism* (e.g., "How much do you and this person get annoyed with each other's behavior?").

4.2.5 The brief resilience scale

Resilience was measured using the Brief Resilience Scale (BRS; Smith et al., 2008). This instrument contained six items that were evaluated using a 7-point Likert scale with 1 = strongly disagree, 4 = neutral, and 7 = strongly agree. Three items were positively worded (e.g., "I tend to bounce back quickly after hard times.") and three items were negatively worded (e.g., "I have a hard time making it through stressful events"). A recent large-scale investigation involving over 10,000 participants recruited from 21 countries (i.e., Zhou & Ma, 2025) found evidence for the high reliability of this measure and concluded that the BRS "is a valuable psychometric tool for resilience research" (p. 1).

4.3 Data analysis

Prior to conducting latent profile analyses (LPAs), the factorial validity of the scores of each scale was examined by means of confirmatory factor analyses. LPAs were

employed to identify the latent profiles (i.e., the combinations/configurations) defined by the six BPNS&F dimensions (i.e., autonomy satisfaction/frustration, competence satisfaction/frustration, and relatedness satisfaction/frustration). Separate LPAs were conducted for the NZ and HI data. LPA is a mixture-modeling method (Harring & Hodis, 2016) that helps identify unobserved subpopulations defined by distinct patterns of the profile indicators (Howard & Hoffman, 2018). The different configurations of profile indicators (i.e., of the six BPNS&F dimensions) are referred to as latent profiles, and the unobserved subgroups they pertain to are called latent classes (Berlin et al., 2014).

In LPA, each participant is assigned to only one latent class (or profile), which is based on posterior probabilities, the likelihood that an individual belongs to a particular profile (Ferguson et al., 2020; Spurk et al., 2020). Local independence assumes profile indicators are uncorrelated within each latent profile, and any covariances among indicators are attributed to their shared latent class (Nylund-Gibson & Choi, 2018). Local independence was imposed in the present research to ensure the parsimony of the models examined and facilitate the stability of numerical estimation algorithms underpinning LPA (Tein et al., 2013). LPA involves three steps—latent class enumeration, latent profile description, and covariate analysis. Latent class enumeration helps identify the number of unobserved classes that best models the data (Burić et al., 2021). This iterative process involves estimating and comparing models with different numbers of classes. Enumeration is informed by several statistical indices (details follow) and considers the conceptual meaningfulness of the profiles uncovered (Ferguson et al., 2020).

Absolute and relative fit indices were used to examine how well a model fits the data (Berlin et al., 2014). Absolute fit measures the consistency between the overall model and the data (Masyn, 2013). In the current study, three absolute fit indices were considered in the enumeration step—Akaike's information criterion (AIC; Akaike, 1998), the Bayesian information criterion (BIC; Schwarz, 1978), and the sample-size adjusted BIC (SABIC; Sclove, 1987). For these fit indices, lower values indicate better model fit (Burić et al., 2021). Relative fit describes how a given model fits in comparison to another model (Masyn, 2013). Two likelihood ratio tests (i.e., the Lo-Mendell-Rubin adjusted likelihood ratio test, ALRT, Lo et al., 2001; the bootstrapped likelihood ratio test, BLRT, McLachlan & Peel, 2000) were used to compare a target model with a model containing one less class (Spurk et al., 2020). Likelihood ratio tests with a p-value less than 0.05 indicate that the given model has a better fit than a model with one less class (Burić et al., 2021; Gao et al., 2022; Howard & Hoffman, 2018).

Accuracy in LPA is the confidence of correctly assigning participants into the appropriate latent class (Spurk et al., 2020). One measure of accuracy is class separation—the degree classes are distinguishable from one another (Masyn, 2013). Entropy quantifies class separation and is represented by a score between 0 and 1, with higher values representing greater class separation (Ferguson et al., 2020). An entropy value of or greater than 0.7 is considered acceptable (Gao et al., 2022).

In the second step of LPA, the identified profiles were described in terms of their BPNS&F patterns. To do so, for each profile, we calculated the mean and variance for the six profile indicators and the number (percentage) of individuals assigned to each

latent class. We used independent *t*-tests to evaluate whether mean profile indicators were significantly different across the latent classes identified.

In the third step, we used Bolck et al.'s (2004) BCH approach to examine similarities and differences among the latent classes with regard to eager/vigilant strategies, resilience, and friendship quality factors. That is, after the model with the optimal number of classes for each data set (i.e., NZ, HI) was determined, the AUXILIARY=BCH option in Mplus (Asparouhov & Muthén, 2014) was implemented. Mplus version 8.8 (Muthén & Muthén, 2017) was employed to carry out the LPAs. All available data were utilized by employing full information maximum likelihood estimation (FIML; Arbuckle, 1996) with the robust estimator MLR implemented in Mplus (Muthén & Muthén, 2017).

5 Results

5.1 Missing data

There were little missing data in each sample. Specifically, for the NZ sample, 374 of the 385 participants provided complete data (i.e., 97.14%). At the item level, in this sample, only 12 of the 65 non-demographic items (i.e., 18.46%) contained any missing data; the maximum percentage of missing data per item was very small (i.e., 0.52%). Similarly, for the HI sample, 369 of the 386 respondents provided complete data (i.e., 95.60%). At the item level, in the HI sample, 40 out of the 65 non-demographic items (i.e., 61.54%) contained missing data; the maximum percentage of data missing for an item was very small (i.e., 1.04%).

5.2 Confirmatory factor analyses and descriptive statistics

As previously indicated, prior to conducting LPAs, the factorial validity of the scores of each scale was examined (by means of CFAs) and found to be satisfactory. The results of the CFAs, which include model fit indices as well as standardized factor loadings and standard errors for all the construct indicators, are reported in the Online Supplemental Material (OSM). In preparation for the LPA, for each construct, the mean score of the construct's indicators was calculated. Tables 3 and 4 report the descriptive statistics for each factor, the corresponding number of items, reliabilities, and intercorrelations among need satisfaction and frustration factors for the NZ and HI samples, respectively.

5.3 Latent class enumeration and latent profile characteristics

5.3.1 Latent class enumeration for New Zealand sample

The first step of the LPA, which provides an answer to the first research question we examined (RQ1), was finding the number of classes. Table 5 summarizes the statistical indexes used to inform latent class enumeration for the NZ sample. Models with eight or more classes were not considered because they were associated with estima-

Table 5 Statistical criteria associated with latent class enumeration for the New Zealand sample

Model	SSS	LL	No. parameters	AIC	BIC	SABIC	*p*-ALRT	*p*-BLRT	Entropy
1 Class	385	− 3758.780	12	7541.559	7588.998	7550.924	–	–	–
2 Class	151	− 3404.556	25	6859.113	6957.944	6878.622	0.0000	0.0000	0.847
3 Class	54	− 3310.622	38	6697.243	6847.467	6726.897	0.0219	0.0000	0.835
4 Class	50	− 3262.936	51	6627.873	6829.488	6667.671	0.0834	0.0000	0.821
5 Class	46	− 3219.581	64	6567.163	6820.170	6617.106	0.0216	0.0000	0.817
6 Class	20	− 3178.099	77	6510.198	**6814.598**	6570.287	0.0182	0.0000	0.848
7 Class	28	− 3143.841	90	**6467.682**	6823.474	**6537.916**	0.8070	**0.0051**	**0.853**

SSS the smallest sample size associated with any of the classes identified by the given model, *LL* log-likelihood, *AIC* Akaike information criterion, *BIC* Bayesian information criterion, *SABIC* sample-size adjusted BIC, *p-ALRT* the *p*-value associated with the Lo-Mendell-Rubin adjusted likelihood ratio test, *p-BLRT* the *p*-value associated with the bootstrapped likelihood ratio test

Values in bold denote that the respective index suggests extracting a model with the specific number of classes

tion problems, which suggest the possibility of extracting too many classes. Models with 2–5 classes were not retained due to their relatively high AIC, BIC, and SABIC values, leaving the 6-class and 7-class models for further consideration. For these information criteria, lower values indicate better model-data alignment than higher values do (Harring & Hodis, 2016). The AIC and SABIC favored the 7-class model, whereas the BIC favored the 6-class model. The 7-class model *p*-ALRT suggested that the 7-class model did not provide a significantly better fit than the 6-class model, whereas the 7-class *p*-BLRT suggested the 7-class model was significantly better than the 6-class model. The 7-class model had a higher entropy value than the 6-class model. Given that four of the six indexes (i.e., AIC, SABIC, *p*-BLRT, and entropy) favored the 7-class model, the 7-class model was deemed the optimal representation for the NZ data.

5.4 Latent class enumeration for Hawai‘i sample

Table 6 summarizes the statistical indexes used to inform latent class enumeration for the HI sample. The 2-class model was not retained due to its high AIC, BIC, and SABIC values. The 5-class and 6-class models were not considered because they involved very small classes (i.e., $n = 10$ participants). Models with eight classes or more were not viable representations of the data as the best log-likelihood was not replicated, suggesting the over-extraction of latent classes. This left the 3-class, 4-class, and 7-class models for further consideration. Given that the AIC, SABIC, and BLRT supported the 7-class model and that this model had the highest entropy of the three competing models, the 7-class model was deemed most appropriate. Con-

Table 6 Statistical criteria associated with latent class enumeration for the Hawai'i sample

Model	SSS	LL	No. parameters	AIC	BIC	SABIC	*p*-ALRT	*p*-BLRT	Entropy
1 Class	386	− 3631.380	12	7286.760	7334.230	7296.155	–	–	–
2 Class	141	− 3288.734	25	6627.467	6726.363	6647.041	0.0000	0.0000	**0.854**
3 Class	79	− 3181.640	38	6439.280	6589.602	6469.032	**0.0100**	0.0000	0.791
4 Class	72	− 3136.125	51	6374.250	**6575.998**	6414.180	0.3107	0.0026	0.768
5 Class	10	− 3100.098	64	6328.197	6581.371	6378.306	0.1342	0.0317	0.802
6 Class	10	− 3073.317	77	6300.633	6605.233	6360.921	0.5053	0.0608	0.798
7 Class	31	− 3038.977	90	**6257.955**	6613.980	**6328.420**	0.6522	**0.0000**	0.806

SSS the smallest sample size associated with any of the classes identified by the given model, *LL* log-likelihood, *AIC* Akaike information criterion, *BIC* Bayesian information criterion, *SABIC* sample-size adjusted BIC, *p-ALRT* the *p*-value associated with the Lo-Mendell-Rubin adjusted likelihood ratio test, *p-BLRT* the *p*-value associated with the bootstrapped likelihood ratio test

Values in bold denote that the respective index suggests extracting a model with the specific number of classes

sidering the results of the LPAs in both samples, the 7-class model provided the most appropriate description for the data in both NZ and HI samples.

5.5 Latent profile characteristics

5.5.1 New Zealand 7-class model profile description

In the following, we provide a description of the BPNS&F profiles associated with each latent class in the NZ sample; for graphical and tabular representations of these profiles, see Fig. 1; Table 7. The term *average* in this context refers to the mean value of the given construct in the entire NZ sample.

Class 1, C1 (pink, $n = 78$, 20.26% of the total number of NZ participants), the second most common profile, was distinguished by slightly above average satisfaction and below average frustration for all needs; thus, the *C1* profile is labeled as *about average satisfaction and below average frustration*. In this profile, relatedness satisfaction was slightly stronger than autonomy satisfaction and competence satisfaction (which were comparable in strength), whereas relatedness frustration was lower than autonomy frustration and competence frustration, which were similar in magnitude.

C2 (light blue, $n = 41$, 10.65%) was defined by average autonomy satisfaction, above average competence satisfaction, below average relatedness satisfaction, average autonomy frustration, below average competence frustration, and slightly above average relatedness frustration; the *C2* profile is labeled as *average autonomy with positive outlook on competence and negative outlook on relatedness*. In this profile, competence satisfaction was stronger than autonomy satisfaction and relatedness sat-

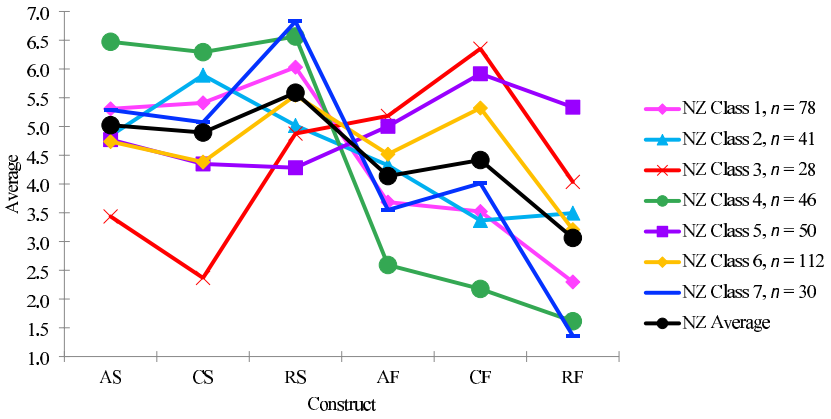

Fig. 1 New Zealand sample: the model with seven latent classes (i.e., seven BPNS&F profiles). AS autonomy satisfaction, AF autonomy frustration, CS competence satisfaction, CF competence frustration, RS relatedness satisfaction, RF relatedness frustration, Profile labels: C1 about average satisfaction and below average frustration, C2 average autonomy with positive outlook on competence and negative outlook on relatedness, C3 low satisfaction and high frustration, C4 high satisfaction and low frustration, C5 low/below average satisfaction and high frustration, C6 average satisfaction and frustration with a negative competence outlook, C7 average satisfaction/frustration with dominant relatedness

isfaction, whereas autonomy frustration was stronger than competence frustration and relatedness frustration, which were of similar magnitude.

C3 (red, $n=28$, 7.27%), the least common profile, was characterized by low autonomy satisfaction and competence satisfaction, below average relatedness satisfaction, high autonomy frustration and competence frustration, and above average relatedness frustration; the *C3* profile is labeled as *low satisfaction and high frustration*. Of all profiles uncovered in the NZ sample, the *low satisfaction and high frustration* profile had the lowest satisfaction and highest frustration for autonomy and competence and the second lowest satisfaction (as well as the second highest frustration) for relatedness.

C4 (green, $n=46$, 11.95%) was defined by high (and similar) satisfaction and low frustration for all needs; regarding the latter, autonomy frustration was somewhat stronger than competence frustration and relatedness frustration; *C4* is labeled as *high satisfaction and low frustration*. This profile exhibited the highest satisfaction levels and lowest frustration levels for autonomy and competence as well as the second highest satisfaction and second lowest frustration for relatedness among the profiles identified in the NZ sample.

C5 (purple, $n=50$, 12.99%) was defined by slightly below average autonomy satisfaction, below average competence satisfaction, low relatedness satisfaction, and high frustration for all needs; *C5* is labeled as *low/below average satisfaction and high frustration*. In this profile, autonomy satisfaction, competence satisfaction, and relatedness satisfaction were comparable in strength; competence frustration was stronger than relatedness frustration, which was stronger than autonomy frustration. Of note, this profile had the lowest satisfaction and highest frustration for relatedness among the seven profiles uncovered in the NZ sample.

Table 7 New Zealand sample: descriptive statistics for classes and total sample of the seven-class model

NZ latent class	*N*	%	AS		CS		RS		AF		CF		RF	
			M	Var	M	Var	M	Var	M	Var	M	Var	M	Var
Class 1	78	20.26	5.31^{a}	0.38	5.41^{a}	0.30	6.03^{a}	0.32	3.69^{a}	0.72	3.52^{a}	0.57	2.30^{a}	0.29
Class 2	41	10.65	4.84^{be}	1.68	5.89^{b}	0.53	5.02^{b}	0.72	4.33^{b}	1.84	3.37^{a}	0.75	3.49^{b}	1.08
Class 3	28	7.27	3.44^{c}	0.61	2.37^{c}	0.27	4.88^{b}	0.27	5.18^{c}	0.84	6.35^{b}	0.18	4.04^{c}	1.00
Class 4	46	11.95	6.47^{d}	0.16	6.29^{d}	0.15	6.57^{c}	0.19	2.59^{d}	1.06	2.18^{c}	0.46	1.61^{d}	0.32
Class 5	50	12.99	4.77^{b}	0.89	4.35^{e}	0.80	4.28^{d}	1.17	5.00^{c}	0.77	5.92^{d}	0.58	5.34^{e}	0.50
Class 6	112	29.10	4.74^{b}	0.66	4.38^{e}	0.63	5.54^{e}	0.62	4.52^{b}	0.86	5.32^{e}	0.59	3.21^{b}	0.52
Class 7	30	7.79	5.29^{ae}	0.32	5.07^{f}	0.69	6.83^{f}	0.03	3.55^{a}	2.15	4.01^{f}	1.75	1.36^{f}	0.09
Total sample	385	100	5.02	1.14	4.90	1.46	5.59	1.08	4.14	1.62	4.42	2.33	3.06	1.86

AS autonomy satisfaction, *AF* autonomy frustration, *CS* competence satisfaction, *CF* competence frustration, *RS* relatedness satisfaction, *RF* relatedness frustration

Mean values in a column that share a common superscript do not differ significantly at the 0.05 level of significance

C6 (yellow, $n=112$, 29.10%), the most common profile, was characterized by slightly below average autonomy satisfaction, below average competence satisfaction, average relatedness satisfaction, above average autonomy frustration, above average competence frustration, and average relatedness frustration; the *C6* profile is labeled as *average satisfaction and frustration with a negative competence outlook*. In this profile, relatedness satisfaction was stronger than autonomy satisfaction and competence satisfaction, which were similar in strength. Competence frustration was stronger than autonomy frustration, which was stronger than relatedness frustration.

C7 (dark blue, $n=30$, 7.79%) was identified by slightly above average satisfaction and below average frustration for autonomy and competence, as well as by high satisfaction and low frustration for relatedness; the C7 profile is labeled *average satisfaction/frustration with dominant relatedness*. For relatedness, this profile had the highest satisfaction and lowest frustration among the profiles identified in the NZ sample. In addition, relatedness satisfaction was stronger than autonomy satisfaction and competence satisfaction, which were similar; relatedness frustration was lower than autonomy frustration and competence frustration.

5.6 Hawai‘i 7-class model profile descriptions

In the following, we describe the BPNS&F profiles associated with each latent class in the HI sample; see Fig. 2; Table 8 for graphical/tabular representations. The term *average* refers to the mean value of the given construct in the entire HI sample.

C1 (*high satisfaction and low frustration*; green, $n=31$, 8.03% of the total number of HI participants), the least common HI profile, was characterized by high (and similar) satisfaction and low (and similar) frustration for all needs. This profile not only had the highest satisfaction for autonomy and competence and the second highest satisfaction for relatedness but also the lowest frustration for all needs among all profiles uncovered in the HI sample.

C2 (*above average satisfaction and below average frustration;* light blue, $n=69$, 17.88%), was the second most common HI profile. In this profile, autonomy, competence, and relatedness satisfaction had similar strengths; autonomy frustration was stronger than competence frustration and relatedness frustration; the latter were similar in strength.

C3 (*average satisfaction and frustration with a negative competence outlook*; yellow, $n=87$, 22.54%), the most common profile, had average autonomy satisfaction, below average competence satisfaction, and average relatedness satisfaction. In addition, this profile had above average autonomy frustration, above average/high competence frustration, and average relatedness frustration. Relatedness satisfaction was stronger than autonomy satisfaction and competence satisfaction, which were similar; competence frustration was slightly stronger than autonomy frustration and much stronger than relatedness frustration.

C4 (*about average satisfaction and below average frustration*; pink, $n=54$, 13.99%) was characterized by slightly below average autonomy and competence satisfaction and average relatedness satisfaction as well as below average frustration for all needs. Relatedness satisfaction was slightly higher than autonomy and competence satisfaction, which were very similar in strength. Relatedness frustration was

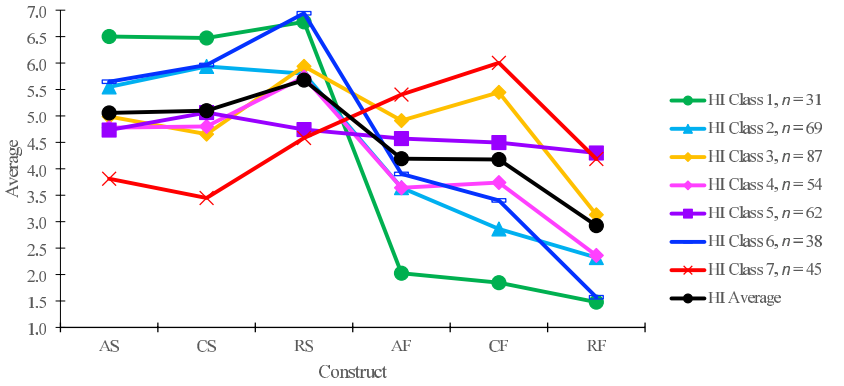

Fig. 2 Hawai'i sample: the model with seven latent classes (i.e., seven BPNS&F profiles). AS autonomy satisfaction, AF autonomy frustration, CS competence satisfaction, CF competence frustration, RS relatedness satisfaction, RF relatedness frustration, Profile labels: C1 high satisfaction and low frustration, C2 above average satisfaction and below average frustration, C3 average satisfaction and frustration with a negative competence outlook, C4 about average satisfaction and below average frustration, C5 low/below average satisfaction and above average/high frustration, C6 above average satisfaction and below average frustration with dominant relatedness, C7 low satisfaction and high frustration

lower than autonomy frustration and competence frustration; the latter were similar in strength.

C5 (*low/below average satisfaction and above average/high frustration;* purple, $n = 62$, 16.06%) was defined by slightly below average autonomy satisfaction, average competence satisfaction, and low relatedness satisfaction. In addition, this profile had slightly above average (and comparable) autonomy and competence frustration and high relatedness frustration (which was similar in magnitude to autonomy and competence frustration). This profile had the second lowest relatedness satisfaction and the highest relatedness frustration of all profiles identified in the HI sample.

C6 (*above average satisfaction and below average frustration with dominant relatedness*; dark blue, $n = 38$, 9.85%), the second least common profile, was characterized by above average/high autonomy and competence satisfaction and high relatedness satisfaction. In addition, this profile had below average autonomy and competence frustration and very low relatedness frustration. Relatedness satisfaction was stronger than autonomy satisfaction and competence satisfaction, which were comparable in magnitude. Relatedness frustration was lower than autonomy frustration and competence frustration, which were similar in strength. This profile had the highest relatedness satisfaction and the second lowest relatedness frustration of all profiles in the HI sample.

C7 (*low satisfaction and high frustration*; red, $n = 45$, 11.66%) was defined by low satisfaction and high frustration for all needs. In the HI sample, this profile displayed the lowest satisfaction for all needs, the highest frustration for autonomy and competence, and the second highest frustration for relatedness. In this *low satisfaction and high frustration* profile, relatedness satisfaction was higher than autonomy satisfaction and competence satisfaction, which were similar in strength. Competence frus-

Table 8 Hawai'i sample: descriptive statistics for classes and total sample of the seven-class model

HI latent class	*N*	%	AS		CS		RS		AF		CF		RF	
			M	Var	M	Var	M	Var	M	Var	M	Var	M	Var
Class 1	31	8.03	6.50^{a}	0.13	6.47^{a}	0.18	6.78^{a}	0.10	2.03^{a}	0.49	1.85^{a}	0.34	1.48^{a}	0.14
Class 2	69	17.88	5.55^{b}	0.36	5.94^{b}	0.22	5.80^{b}	0.42	3.64^{b}	0.86	2.86^{b}	0.68	2.32^{b}	0.75
Class 3	87	22.54	4.99^{c}	0.56	4.66^{c}	0.34	5.94^{b}	0.30	4.91^{c}	0.84	5.45^{c}	0.56	3.13^{c}	0.77
Class 4	54	13.99	4.78^{c}	0.26	4.80^{c}	0.20	5.74^{b}	0.45	3.64^{b}	0.78	3.74^{d}	0.38	2.36^{b}	0.35
Class 5	62	16.06	4.73^{c}	0.80	5.06^{d}	0.59	4.74^{c}	0.73	4.57^{d}	1.19	4.50^{e}	0.65	4.30^{d}	0.56
Class 6	38	9.85	5.65^{b}	0.87	5.96^{b}	0.54	6.94^{d}	0.01	3.90^{b}	1.95	3.40^{d}	1.37	1.57^{a}	0.37
Class 7	45	11.66	3.81^{d}	0.45	3.45^{e}	0.66	4.58^{c}	1.00	5.40^{e}	0.91	6.00^{f}	0.45	4.19^{d}	1.50
Total sample	386	100	5.06	0.95	5.10	1.11	5.68	1.00	4.19	1.75	4.18	2.21	2.93	1.63

AS autonomy satisfaction, *AF* autonomy frustration, *CS* competence satisfaction, *CF* competence frustration, *RS* relatedness satisfaction, *RF* relatedness frustration

Mean values in a column that share a common superscript do not differ significantly at the 0.05 level of significance

tration was stronger than autonomy frustration and much stronger than relatedness frustration.

5.7 Comparing profile characteristics in the NZ and HI samples

To answer the second research question (RQ2), we compared the shape/structure of the seven profiles identified in each sample. This comparison shows that four profiles had almost identical shapes in the NZ and HI samples. These profiles were the ones labeled *high satisfaction and low frustration* (green), *low satisfaction and high frustration* (red), *average satisfaction and frustration with a negative competence outlook* (yellow), and *average satisfaction/frustration with dominant relatedness* (dark blue; see Figs. 1 and 2). The remaining three profiles were comparable in the two samples (with regard to their shape and the absolute and relative strengths of their corresponding profile indicators). Table 9 provides detailed comparisons of the profiles identified in the two samples.

5.8 Similarities and differences among NZ BPNS&F profiles with regard to motivation, resilience, and friendship quality

A key goal of this research was to compare the seven profiles identified in the NZ sample in terms of eager/vigilant strategies, resilience, and friendship quality (i.e., Social Network Questionnaire, SNQ; seeks safe haven, SSH; seeks secure base, SSB; provides safe haven, PSH; provides secure base, PSB; companionship, COMP; negative interactions, N). The results of these analyses (see Table 10), which indicated significant differences among classes with regard to all factors examined, support the three hypotheses we examined in this research. The implications of the patterns of similarities/differences in these factors are overviewed in the Discussion section.

For the NZ sample, the *high satisfaction and low frustration* profile (i.e., C4—green; see Table 9; Fig. 1), had higher mean values for eagerness and resilience than all other classes (profiles). In addition, this profile and the *average satisfaction/frustration with dominant relatedness* profile (i.e., C7—dark blue) had the highest mean values for SNQ, with the remaining classes/profiles (except the *low/below average satisfaction and high frustration* profile; i.e., C5—purple) falling closely behind. These results provided support for the first and third hypotheses we examined (i.e., H1 and H3). Findings also supported the second hypothesis (H2). That is, the *low satisfaction and high frustration* profile (C3—red) had low or very low values for eagerness, resilience, and some of the friendship quality factors (e.g., SSB, PSH, COMP).

Regarding vigilance, the *low/below average satisfaction and high frustration* profile and the *average satisfaction and frustration with a negative competence outlook* profile (i.e., C6—yellow) displayed the highest mean values. In contrast, the *high satisfaction and low frustration* profile exhibited the lowest mean vigilance among classes. In terms of the friendship quality factors (i.e., SSH, SSB, PSH, PSB, COMP, N), the *about average satisfaction and below average frustration* profile (i.e., C1—pink), the *high satisfaction and low frustration profile* (i.e., C4—green), and the *average satisfaction/frustration with dominant relatedness* profile (i.e., C7—dark blue) were the most adaptive. Of note, not all differences between these profiles (i.e., C1,

Table 9 Comparison of BPNS&F profiles in New Zealand 7-class model and Hawai'i 7-class model

Profile name and color	New Zealand	Hawai'i
High satisfaction and low frustration; Green	High satisfaction for all needs Low frustration for all needs C4; $n=46$	High satisfaction for all needs Low frustration for all needs C1; $n=31$
Low satisfaction and high frustration; Red	Low or below average satisfaction for all needs High or above average frustration for all needs C3; $n=28$	Low satisfaction for all needs High frustration for all needs C7; $n=45$
Average satisfaction and frustration with a negative competence outlook; Yellow	Slightly below average AS, below average CS, average RS Above average AF, above average CF, and average RF C6; $n=112$	Average AS, below average CS, average RS Above average AF, above average/high CF, and average RF C3; $n=87$
Average satisfaction/frustration with dominant relatedness[1]; Dark blue	Slightly above average AS, slightly above average CS, high RS Below average AF, below average CF, and low RF C7; $n=30$	Above average/high AS, above average/high CS, high RS Below average AF, below average CF, and very low RF C6; $n=38$; [1] = the label of this profile in the HI sample is: *Above average satisfaction and below average frustration with dominant relatedness*
Average autonomy with positive outlook on competence and negative outlook on relatedness[2]; Light blue	Average AS, above average CS, below average RS, Average AF, below average CF, and slightly above average RF C2; $n=41$	Above average AS, above average CS, above average RS Below average/low frustration for all needs C2; $n=69$; [2] = the label of this profile in the HI sample is: *Above average satisfaction and below average frustration*
Low/below average satisfaction and high frustration[3]; Purple	Slightly below average AS, below average CS, low RS High frustration for all needs C5; $n=50$	Slightly below average AS, average CS, low RS Slightly above average AF, slightly above average CF, and high RF C5; $n=62$; [3] = the label of this profile in the HI sample is: *Low/below average satisfaction and above average/high frustration*
About average satisfaction and below average frustration; Pink	Slightly above average satisfaction for all needs Below average frustration for all needs C1; $n=78$	Slightly below average AS, slightly below average CS, average RS Below average frustration for all needs C4; $n=54$

AS autonomy satisfaction, *AF* autonomy frustration, *CS* competence satisfaction, *CF* competence frustration, *RS* relatedness satisfaction, *RF* relatedness frustration

C4, and C7), on the one hand, and the remaining classes, on the other, were statistically significant; see Table 10 for complete information about the significance (or lack thereof) of mean differences between classes in the NZ sample.

5.9 Similarities and differences among HI BPNS&F profiles with regard to motivation, resilience, and friendship quality

For the HI sample, the *high satisfaction and low frustration* profile (i.e., C1—green) had the strongest mean eagerness and resilience of any other class; see Table 11;

Table 10 New Zealand sample: descriptive statistics and results of tests of significance for differences among classes regarding motivation, resilience, and friendship quality factors

Latent class	%	E		V		BRS		SNQ		SSH		SSB		PSH		PSB		COMP		*N*	
		M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE
1	20.26	5.06^{a}	0.10	4.60^{a}	0.14	4.36^{a}	0.13	5.84^{a}	0.10	2.64^{ab}	0.14	3.57^{ab}	0.12	2.75^{ab}	0.13	3.66^{a}	0.11	2.93^{abc}	0.13	1.23^{a}	0.05
2	10.65	5.17^{a}	0.24	4.44^{a}	0.25	4.47^{a}	0.25	5.78^{a}	0.16	2.49^{ac}	0.23	3.06^{c}	0.20	2.28^{a}	0.22	3.26^{a}	0.17	2.51^{a}	0.20	1.62^{b}	0.13
3	7.27	3.63^{d}	0.18	4.95^{ab}	0.21	2.59^{b}	0.22	5.76^{a}	0.20	2.72^{abc}	0.22	3.26^{ac}	0.22	2.36^{a}	0.18	3.59^{ab}	0.21	2.64^{ab}	0.21	1.19^{a}	0.06
4	11.95	5.77^{e}	0.15	3.76^{d}	0.21	5.42^{c}	0.16	6.23^{b}	0.09	3.08^{bd}	0.17	3.94^{b}	0.15	3.01^{b}	0.19	4.07^{bc}	0.14	3.03^{bc}	0.16	1.27^{ac}	0.06
5	12.99	4.56^{bc}	0.15	5.50^{c}	0.17	3.22^{d}	0.17	5.04^{c}	0.17	2.19^{c}	0.17	2.91^{c}	0.18	2.55^{ab}	0.20	3.50^{a}	0.15	2.59^{a}	0.14	1.50^{b}	0.08
6	29.10	4.35^{b}	0.11	5.19^{bc}	0.11	3.25^{d}	0.12	5.85^{a}	0.09	2.67^{ab}	0.13	3.32^{ac}	0.11	2.63^{ab}	0.12	3.61^{a}	0.10	2.86^{abc}	0.10	1.38^{bc}	0.06
7	7.79	4.92^{ac}	0.24	4.79^{ab}	0.21	4.32^{a}	0.22	6.15^{ab}	0.16	3.39^{d}	0.25	4.03^{b}	0.19	3.06^{b}	0.22	4.16^{c}	0.17	3.34^{c}	0.23	1.42^{abc}	0.13
Tot. Spl.	100	4.77	1.13	4.81	1.22	3.90	1.33	5.80	0.88	2.69	1.16	3.41	1.04	2.66	1.12	3.66	0.93	2.84	1.01	1.37	0.52

E eager strategies, *V* vigilant strategies, *BRS* resilience, *SNQ* social network questionnaire friendship quality, *SSH* seeks safe haven, *SSB* seeks secure base, *PSH* provides safe haven, *PSB* provides secure base, *COMP* companionship, *N* negative interactions, *Tot. Spl.* total sample, *M* mean, *SE* standard error

For the total sample, standard deviations are reported instead of standard errors

Mean values in a column that share a common superscript do not differ significantly at the 0.05 level of significance

these results provided support for H1. The *average satisfaction/frustration with a negative competence outlook* profile (i.e., C3—yellow) and the *low satisfaction and high frustration* profile (i.e., C7—red) had the lowest mean resilience; these findings were consistent with H3. For vigilance, the *average satisfaction/frustration with a negative competence outlook* profile (C3—yellow) and the *above average satisfaction and below average frustration with dominant relatedness profile* (C6—dark blue) had the highest mean values, whereas the *high satisfaction and low frustration* profile (C1—green) had the lowest mean value. In terms of the friendship quality factors, the *high satisfaction and low frustration* profile (C1—green) and the *above average satisfaction and below average frustration with dominant relatedness profile* (C6—dark blue) were the most adaptive; these results provided support for H2. Of note, not all mean differences involving C1 and C6 were statistically significant; see Table 11 for complete information on the significance of mean differences between profiles in the HI sample.

6 Discussion

This research mapped the complex associations of BPNS&F dimensions by uncovering BPNS&F profiles in two samples of undergraduate students from NZ and HI and compared these profiles with regard to regulatory focus orientations, resilience, and friendship quality factors. Seven BPNS&F profiles were identified in each sample. These profiles were generally similar in the two samples, with some differences. In both samples, there were significant differences among profiles for all motivation, resilience, and friendship quality factors investigated. Consistent with theoretical expectations (Ryan & Deci, 2017; Vansteenkiste et al., 2023), for both samples, the most adaptive profile we identified had *high satisfaction and low frustration* of all needs. This profile had the highest levels of eagerness and resilience and the highest/second highest levels of friendship quality factors of all profiles. Yet again in line with theory, the most maladaptive profile had *low satisfaction and high frustration* of all needs. In both samples, this profile was associated with the lowest levels of eagerness and resilience and had generally lower levels of friendship quality factors than most other profiles.

Five of the seven profiles we identified were similar to profiles uncovered in previous studies: (1) The *high satisfaction and low frustration* profile, which was also uncovered in a range of samples drawn from multiple cultures (e.g., Gilbert et al., 2023; Li et al., 2022; Li et al., 2020; Warburton et al., 2020). (2) The *low satisfaction and high frustration* profile, which is similar to profiles identified by Li et al. (2021) and Reed-Fitzke and Lucier-Greer (2020). (3) The *about average satisfaction and below average frustration* profile, which is consistent with a profile uncovered in Rouse et al. (2019). (4) The *average satisfaction/frustration with dominant relatedness* profile, which is comparable to a profile identified by Tóth-Király et al. (2018). (5) The *low/below average satisfaction and high frustration* profile, which is similar to a profile uncovered in Santurio et al. (2021). Two profiles we uncovered in our research have not been previously identified in other studies (i.e., the *average auton-*

Table 11 Hawai'i sample: descriptive statistics and results of tests of significance for differences among classes regarding motivation, resilience, and friendship quality factors

Latent class	%	E		V		BRS		SNQ		SSH		SSB		PSH		PSB		COMP		*N*	
		M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE
1	8.03	6.21^{a}	0.14	4.31^{a}	0.27	5.29^{a}	0.25	6.43^{a}	0.09	3.48^{a}	0.26	4.31^{b}	0.18	3.35^{abc}	0.28	4.30^{a}	0.17	3.74^{a}	0.17	1.23^{a}	0.07
2	17.88	5.61^{b}	0.13	4.77^{ab}	0.15	4.75^{b}	0.11	5.74^{b}	0.11	2.92^{a}	0.15	3.50^{a}	0.12	2.89^{a}	0.15	3.56^{bc}	0.13	3.06^{bc}	0.13	1.43^{abc}	0.07
3	22.54	4.97^{c}	0.13	5.60^{c}	0.11	3.41^{c}	0.13	5.76^{b}	0.14	3.02^{a}	0.15	3.52^{a}	0.13	2.89^{a}	0.15	3.75^{b}	0.11	3.39^{abd}	0.12	1.62^{bc}	0.09
4	13.99	4.62^{c}	0.17	4.72^{ad}	0.16	4.20^{d}	0.13	5.73^{b}	0.18	3.30^{a}	0.21	3.64^{a}	0.17	3.40^{bc}	0.20	3.61^{bc}	0.17	3.27^{abd}	0.17	1.38^{ab}	0.09
5	16.06	4.96^{c}	0.14	4.93^{bd}	0.14	3.98^{d}	0.14	5.16^{c}	0.18	2.46^{b}	0.16	3.06^{c}	0.16	2.31^{d}	0.16	3.26^{c}	0.13	2.79^{c}	0.14	1.70^{c}	0.12
6	9.85	5.63^{b}	0.22	5.27^{bc}	0.21	4.22^{d}	0.18	6.42^{a}	0.13	3.43^{a}	0.22	4.36^{b}	0.17	3.69^{c}	0.21	4.33^{a}	0.18	3.70^{ad}	0.19	1.39^{abc}	0.13
7	11.66	3.84^{d}	0.19	5.52^{c}	0.16	3.00^{c}	0.21	5.62^{bc}	0.17	3.23^{a}	0.22	3.61^{a}	0.18	3.09^{ab}	0.21	3.89^{ab}	0.16	3.23^{bcd}	0.19	1.42^{abc}	0.09
Tot. Spl.	100	5.06	1.13	5.08	1.06	4.04	1.14	5.75	1.01	3.04	1.19	3.60	1.03	3.00	1.18	3.72	0.95	3.25	1.00	1.49	0.61

E eager strategies, *V* vigilant strategies, *BRS* resilience, *SNQ* social network questionnaire friendship quality, *SSH* seeks safe haven, *SSB* seeks secure base, *PSH* provides safe haven, *PSB* provides secure base, *COMP* companionship, *N* negative interactions, *Tot. Spl.* total sample, *M* mean, *SE* standard error

For the total sample, standard deviations are reported instead of standard errors

Mean values in a column that share a common superscript do not differ significantly at the 0.05 level of significance

omy with positive outlook on competence and negative outlook on relatedness and the *average satisfaction/frustration with a negative competence outlook* profiles).

6.1 Similar patterns of need satisfaction/frustration in some profiles and different patterns in other profiles

A common assumption in the need satisfaction-frustration literature is that "satisfaction of one psychological need can facilitate the satisfaction of other needs as well" (Howard et al., 2024, p. 15; Ryan & Deci, 2017). We found support for this assumption in both samples, as illustrated by the *high satisfaction and low frustration* and the *above average satisfaction and below average frustration* profiles. At the same time, in other profiles, the patterns of strengths of the three need satisfaction dimensions were mixed. For example, in the *average autonomy with positive outlook on competence and negative outlook on relatedness* profile (in the NZ sample), autonomy and relatedness satisfaction were below average, whereas competence satisfaction was high. Another mixed pattern of need satisfaction strengths characterized the *average satisfaction/frustration with dominant relatedness* profile (in the NZ sample); in this profile, autonomy and competence satisfaction were of average strength, whereas relatedness satisfaction was strong. The same pattern was apparent in the corresponding profile in the HI sample (i.e., the *above average satisfaction and below average frustration with dominant relatedness* profile). These findings suggest that although all need satisfaction factors share common influences (encompassing environmental and individual difference variables) (Howard et al., 2024), some people exhibit a non-uniform pattern of need satisfaction strengths.

Experiences of need satisfaction and frustration can co-occur (Vansteenkiste et al., 2023). For example, "students can simultaneously experience support and thwarting from teachers, and therefore report high levels of both concurrently" (Howard et al., 2024, p. 3). Thus, it is possible to uncover profiles that have comparable levels on all/most need satisfaction and frustration factors. This was the case for the *low/below average satisfaction and above average/high frustration* profile (identified in the HI sample), which had similar levels of all six need satisfaction and frustration factors. No other profile, in any of the two samples, matched this pattern. Considering that this profile included about 16% of the participants in the given sample, our findings suggest that while it is certainly possible for some people to have similarly satisfied and frustrated basic psychological needs, this pattern is not common.

6.2 Similarities and differences among BPNS&F profiles with regard to motivation, resilience, and friendship quality factors

In this study, we examined eagerness and vigilance, which reflect a promotion and a prevention focus, respectively (Higgins, 1997). In both samples, the BPNS&F profiles associated with the highest mean eagerness scores had high satisfaction and low frustration for all needs. In contrast, the profiles associated with the lowest mean eagerness scores had low satisfaction and high frustration for all needs. These results are consistent with Vaughn's (2017) needs-support model, which proposed that promotion and prevention both influence and are shaped by BPNS. In addition, they align

with findings from prior studies indicating positive associations between promotion and satisfaction of each of the three needs (Aubert et al., 2022; Hodis & Hodis, 2021; Vaughn, 2017; Vaughn et al., 2020) and negative correlations between promotion and the frustration of each need (Hodis & Hodis, 2021). As findings for vigilance were inconsistent across the two samples and difficult to interpret, they are not discussed further; results pertaining to the associations between vigilance/prevention and need satisfaction/frustration reported in other studies are not consistent either (e.g., Aubert et al., 2022; Hodis & Hodis, 2021; Vaughn, 2017; Vaughn et al., 2020).

In both samples, the highest levels of resilience were associated with the *high satisfaction and low frustration* profiles, whereas the lowest resilience corresponded to the *low satisfaction and high frustration* profiles. These results are in line with previous research indicating that resilience positively correlated with the fulfillment of each need (Liu & Huang, 2021; Neufeld & Malin, 2019; Neufeld et al., 2020; Xu et al., 2021). Our results are also consistent with the tenets of SDT, which postulates that effective self-regulation and optimal functioning require the fulfillment of all three needs (Ryan & Deci, 2017). Specifically, although some previous studies found that the relationships between resilience and the satisfaction or frustration of competence were stronger than those between resilience and autonomy or relatedness (e.g., Neufeld & Malin, 2019; Neufeld et al., 2020; Xu et al., 2021), our findings indicate that competence alone (i.e., having high competence satisfaction and low competence frustration) cannot compensate for low satisfaction and/or high frustration of both autonomy and relatedness; for an illustrative example, compare resilience for the *average autonomy with positive outlook on competence and negative outlook on relatedness* (C2) and the *average satisfaction/frustration with dominant relatedness* (C7) profiles in the NZ sample.

The profiles having the highest relatedness satisfaction and the lowest relatedness frustration (together with high satisfaction and low frustration for autonomy and competence) were the most adaptive with regard to friendship, suggesting that satisfaction of basic needs predicts "a more open, prosocial, and flexible interpersonal attitude" (Vansteenkiste et al., 2023, p. 93). The profiles that had the lowest relatedness satisfaction and the highest relatedness frustration (together with below average autonomy and competence satisfaction and high autonomy and competence frustration) were the least adaptive regarding friendship quality. These results support the hypothesis that need frustration is linked to "self-centered, defensive, and rigid interpersonal attitudes" (Vansteenkiste et al., 2023, p. 94) and are consistent with prior research indicating that the satisfaction/frustration of basic psychological needs corresponds to better/poorer interpersonal relationship quality (Costa et al., 2015; Patrick et al., 2007; La Guardia et al., 2000; Wei et al., 2005; Yang et al., 2021). Consequently, they provide support for hypothesizing that friends are social agents whose behaviors could influence their counterparts' satisfaction and frustration of basic needs (Reshvanloo et al., 2023; Slemp et al., 2024).

6.3 Key contributions of this research and educational implications of its findings

To our knowledge, this research is the first to investigate BPNS&F profiles in the Pacific region and to examine BPNS&F profiles in two different countries within the

same study. These are noteworthy contributions as the literature on needs satisfaction-frustration has primarily relied on data collected outside the Pacific region, usually in a single cultural context. The number and types of profiles we uncovered were consistent in the two samples, and most of the profiles we identified have counterparts in previous research. These aspects indicate that (most of) the need satisfaction and frustration profiles we uncovered are likely to generalize. Thus, as we discuss below, knowledge of these profiles unlocks access to key information that supports efforts to ensure students' need fulfillment in educational settings (e.g., by identifying the dimensions of need satisfaction/frustration that are in most need of intervention).

Meta-analytic results reported by Howard et al. (2024) suggest that competence support is a particularly salient predictor of effective self-regulation. In the same vein, findings in Bureau et al. (2022) indicate that the need for competence might be the "central and most important need for students" (p. 61). Considering these aspects, two profiles of students in the NZ sample and one profile in the HI sample would benefit the most from increasing competence satisfaction and decreasing competence frustration; this is in addition to the most maladaptive profile of *low satisfaction and high frustration*. Specifically, for the NZ sample, the *low/below average satisfaction and high frustration* profile and the *average satisfaction and frustration with a negative competence outlook* profile had below average satisfaction and high/very high frustration of competence. In addition, these profiles had the lowest levels of eagerness and resilience of all profiles (except the most maladaptive profile). Similarly, for the HI sample, the *average satisfaction and frustration with a negative competence outlook* profile had below average competence satisfaction and high competence frustration and the second lowest resilience of all profiles in the HI sample.

Ahmadi et al. (2023) mapped teacher behaviors that could help strengthen students' need satisfaction and reduce their need frustration. Because all the profiles we discussed in the paragraph above have suboptimal levels on both competence satisfaction and competence frustration, both of these dimensions need to be targeted to improve student outcomes. To strengthen competence satisfaction, it is critical that teachers use optimally challenging tasks/activities, offer encouraging, specific, and actionable feedback on students' work, and acknowledge and value their effort and progress (Ahmadi et al., 2023). To reduce students' competence frustration, teachers must avoid using undifferentiated tasks (i.e., tasks that are too challenging for some students and too easy for others) and refrain from providing critical yet vague feedback that does not include clear and actionable suggestions on how students could do better (Ahmadi et al., 2023). Notably, although all these strategies specifically target the competence need, they may provide benefits for other needs as well; this is because many behaviors that support a given need may also serve other needs (Howard et al., 2024). For example, conveying warmth, which is a behavior that directly supports relatedness, had strong positive correlations with both competence and autonomy support. Similarly, participatory behaviors (e.g., providing rationale), which support autonomy, are likely to be beneficial with regard to competence as well (see Howard et al., 2024 for more details).

An examination of the profiles uncovered in our research indicates that with the exception of the *low satisfaction and high frustration* profile, all other profiles had high, average, or slightly below average levels of autonomy satisfaction. As com-

petence-targeting behaviors may also strengthen autonomy (Howard et al., 2024), enhancing autonomy satisfaction may be less of an immediate priority for the profiles we uncovered (with the possible exception of the *low satisfaction and high frustration* profile). At the same time, three profiles identified in both samples had high levels of autonomy frustration (i.e., the *low satisfaction and high frustration* profile; the *low/below average satisfaction and high frustration* profile; the *average satisfaction and frustration with a negative competence outlook* profile). To reduce autonomy frustration for students exhibiting any of these profiles, teachers must avoid using controlling or pressuring language and refrain from using praise as a contingent reward (e.g., praising students only when they solve problems in the teacher's preferred way) (Ahmadi et al., 2023).

Two profiles, which were identified in both samples, appear especially vulnerable with regard to relatedness (i.e., the *low satisfaction and high frustration* profile and the *low/below average satisfaction and high frustration* profile). To strengthen relatedness satisfaction for students exhibiting these profiles, teachers could demonstrate unconditional high regard for all students and show warmth/kindness toward them (Ahmadi et al., 2023). In addition, designing collaborative activities with opportunities to develop supportive peer relationships could enhance students' relatedness satisfaction (Escandell & Chu, 2023). To reduce students' relatedness frustration, teachers must refrain from using sarcastic tone/language and avoid providing conditional positive regard or making students feel that "they are not valued or cared for and that their efforts are not noticed" (Ahmadi et al., 2023, p. 1169).

6.4 Limitations and directions for future research

While this study bridged important gaps in existing knowledge, it is not without limitations. Case in point, in both samples, most participants were female (i.e., 71% in the NZ sample; 66% in the HI sample). Reed-Fitzke and Lucier-Greer (2021) pointed out that samples with disproportionate gender representation may magnify or lessen the strength of profile indicators. Similarly, Chen et al. (2015) found that males tend to report stronger competence satisfaction, and females tend to report stronger relatedness satisfaction. Another limitation is that the data collected for this research do not enable the examination of causal relationships between the types of profiles identified and the factors investigated (i.e., eager/vigilant strategies, resilience, and friendship quality). Longitudinal designs help overcome this limitation because they facilitate understanding the interplay between BPNS&F profiles and different factors as well as the temporal stability of BPNS&F profiles; for an example, see Krijgsman et al. (2025).

Although in both samples the need satisfaction and frustration dimensions had strong reliabilities and only moderately overlapped, recent research raised some questions about the instrument we used to gauge these factors. Specifically, Murphy and colleagues (2023) highlighted concerns about the face validity of need frustration items and found that method effects associated with item wording had a stronger influence on the associations among indicators of different satisfaction/frustration dimensions than did the need dimensions. In addition, their results indicated that the autonomy dimension may not function in the same way as the competence and

relatedness dimensions do. Thus, the findings of our work may need to be considered in light of these concerns. At the same time, a recent investigation involving over 76,000 participants recruited from 32 countries (Grubbs et al., 2025) found support for the 6-factor structure of the Chen et al. (2015) scale and concluded that this scale "is a reliable measure of basic psychological needs across the globe" (p. 1).

This research found significant differences among BPNS&F profiles with regard to two motivation factors illustrating promotion and prevention foci. However, several other constructs play key roles in motivating students' behaviors (e.g., expectancy of success; value and cost beliefs; Wigfield & Eccles, 2000; fixed and incremental mindsets; Dweck & Yeager, 2019). Thus, future research could explore the interrelationships of BPNS&F profiles with these motivation factors. Future research is also needed to explain why some BPNS&F profiles were associated with higher quality friendships on some but not all friendship factors.

Recent studies have drawn from basic psychological needs theory to propose strategies to promote positive behavioral, emotional, and psychological outcomes (e.g., Guay, 2022; Juwono & Szabo, 2020; Ntoumanis et al., 2021; Teixeira et al., 2020). Future work could build upon this research and incorporate our findings that BPNS&F profiles where autonomy and competence were highly satisfied and not highly frustrated were associated with high levels of resilience. Specifically, future research could investigate whether implementing autonomy-supportive practices (e.g., giving students the opportunity to select some course materials and/or assignments in ways that align with their goals) and competence-supportive practices (e.g., scaffolding assignments so that students are appropriately supported and challenged) helps strengthen students' resilience in learning settings.

Our research found that the number and the types of BPNS&F profiles identified were similar in the NZ and HI samples. In addition, the patterns of similarities and differences across these profiles regarding eager strategies, resilience, and friendship quality factors were largely consistent in the two samples. Although these results suggest a relatively modest influence of culture (or culture-related factors), future research could use mixed methods or qualitative designs to gain access to rich information "on the varied and subtle manifestations of need-relevant experiences within varying contexts and situations" (Vansteenkiste et al., 2023, p. 97). For example, future research may follow up latent profile analyses with qualitative interviews with participants from each BPNS&F profile to examine in some depth their patterns of use of eager/vigilant strategies, resilience, and friendship; for a study that used qualitative methods to gauge aspects that are relevant to need satisfaction, see Eberle and Hobrech (2021).

7 Conclusion

This research collected data from two large samples of university students from NZ and HI and uncovered seven BPNS&F profiles. As five of these profiles are similar to profiles identified in prior research, the present study contributes to building a taxonomy of BPNS&F configurations that generalize across cultures. In line with an important assumption of SDT, most profiles we identified had similar within-profile

patterns of need strengths, thus indicating positive associations among satisfaction (as well as among frustration) of basic needs. In addition, the research uncovered strong positive (negative) associations between promotion and need satisfaction (frustration) and, thus, advanced understanding of the interrelationships between key motivation factors couched in different theories. Moreover, the investigation found that high satisfaction and low frustration of basic needs underpin resilience; these results highlight the key roles of need satisfaction and frustration in self-regulation. Finally, the results indicate that the quality of critical interpersonal processes (i.e., friendship) is supported by the high satisfaction and low frustration of all basic needs, in general, and of relatedness, in particular; these findings shed fresh light on the meaningful associations between interpersonal processes, on the one hand, and need satisfaction and frustration, on the other hand.

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Declarations

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