

Students' Need Satisfaction Profiles: Similarity and Change over the Course of a University Semester

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Self-determination theory positions the satisfaction of students' needs for autonomy, competence, and relatedness as important determinants of various educational outcomes. In this study, we identify subpopulations of students characterized by distinct configurations of need satisfaction in the educational context, and assess the extent to which the nature of these configurations, and students' individual profiles, remain stable over the course of a university semester. We also examine the role of perfectionism in the prediction of profile membership, and how these profiles relate to a variety of educational outcomes. A total of 521 first-year undergraduate university students completed our measures at the beginning and end of a university semester. We identified five need satisfaction profiles, which remained unchanged over the course of the study. Students characterized by higher levels of self-oriented perfectionism were more

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likely to be a member of a profile characterized by high levels of relatedness and global needs satisfaction associated with average levels of competence need satisfaction ("Globally Satisfied and Highly Connected" profile) relative to the other ones, and into the "Globally Satisfied" profile relative to the "Globally Dissatisfied, Highly Connected, and Competence Deficient" profile. Finally, the "Globally Dissatisfied, Highly Connected, and Competence Deficient" profile was associated with the least desirable outcomes (the lowest levels of students' interest toward their studies, satisfaction, and attendance, and the highest levels of dropout intentions).

INTRODUCTION

According to Self-Determination Theory (SDT; Deci & Ryan, 2000), the satisfaction of three basic psychological needs is proposed to play a central role in the prediction of a wide variety of desirable behaviors, and optimal functioning across life domains, including education (Jang, Reeve, Ryan, & Kim, 2009). These three basic needs refer to relatedness (i.e., expressed via feelings of having a positive connection with others) competence (i.e., expressed via feelings of being able to interact with the environment in an effective manner), and autonomy (i.e., expressed via feelings of psychological freedom and volition). Supporting this assertion, accumulating research evidence has revealed well-differentiated relations between the satisfaction of these needs and a variety of educational outcomes among samples of university students (Emery, Heath, & Mills, 2016; Martela & Ryan, 2016). However, despite their interest, these prior results are limited by their failure to consider the possible combinatory effects of autonomy, competence, and relatedness needs satisfaction. In particular, despite the recognition that individuals might particularly benefit from a balanced (i.e., equivalent) level of satisfaction across all three needs (e.g., Deci & Ryan, 2000; Sheldon & Niemiec, 2006), little is known about the typical configurations that characterize individuals' need satisfaction profiles (reflecting the need satisfaction configuration of specific students), their stability over time, and their effects on educational outcomes. The present study seeks to address this gap. More precisely, it seeks to extend current educational knowledge by: (1) examining the nature of university students' need satisfaction profiles in the educational context while considering their global levels of need satisfaction jointly with the more specific levels of satisfaction of their needs for relatedness, competence, and autonomy; (2) assessing the role of self-oriented and socially prescribed perfectionism in the prediction of these need satisfaction profiles; (3) assessing the impact of profile membership on a variety of outcomes variables related to students' interest toward their studies, dropout intentions, class attendance, and

educational satisfaction; and (4) using a longitudinal design to assess the extent to which the nature of the profiles, as well as individual membership in specific profiles, will remain unchanged over the course of a university semester (Kam, Morin, Meyer, & Topolnytsky, 2016).

THE CRITICAL ROLE OF NEED SATISFACTION

Satisfaction of the basic psychological needs for relatedness, competence, and autonomy has often been described as a critical driver of well-being and desirable educational outcomes, such as students' interest toward their studies (Flunger, Pretsch, Schmitt, & Ludwig, 2013; Sheldon & Filak, 2008) and educational satisfaction (González-Cutre, Sicilia, Sierra, Ferriz, & Hagger, 2016). Conversely, undesirable consequences (e.g., dropout intentions, burnout) are expected for people experiencing a lack of satisfaction of these basic psychological needs (Sulea, van Beek, Sarbescu, Virga, & Schaufeli, 2015; Taylor, Lokes, Gagnon, Kwan, & Koestner, 2012). Empirical evidence has generally supported these expectations across samples of primary, secondary, and university students (Ryan & Deci, 2017). Likewise, these relations appear to hold regardless of whether need satisfaction was operationalized as a single global score (Cheon, Reeve, & Song, 2016; Vansteenkiste, Lens, Soenens, & Luyckx, 2006), or as distinct scores reflecting participants' needs for relatedness, competence, and autonomy (Johnston & Finney, 2010; Niemiec, Ryan, & Deci, 2009).

The Combined Effects of Need Satisfaction Components

According to SDT, all three needs should be satisfied for psychological well-being to occur (Deci & Ryan, 2000). More precisely, SDT proposes that students' functioning should be less optimal (Ryan, 1995) when only a subset of needs is met than when all three needs are satisfied. Sheldon and Niemiec (2006) argued that the benefits of need satisfaction should be greater when the satisfaction of all three psychological needs is in balance (i.e., at a same level). These theoretical perspectives clearly reinforce the importance for research to consider the combined effects of the satisfaction of all three needs using an approach that goes beyond the simple investigation of their additive contribution.

So far, few studies have systematically scrutinized the combined effects of need satisfaction on a variety of outcome measures and in a variety of life contexts (Chang, 2012; Dysvik, Kuvaas, & Gagné, 2013; Sheldon & Filak, 2008; Sheldon & Niemiec, 2006; Vansteenkiste et al., 2006). These studies converged on the conclusion that all three needs have a desirable effect on a variety of outcomes ranging from intrinsic motivation to psychological well-being (Sheldon & Filak, 2008; Sheldon & Niemiec, 2006; Vansteenkiste

et al., 2006). Vansteenkiste et al. (2006) also found that autonomy need satisfaction was most beneficial (i.e., lower levels depression and higher level of vitality) when levels of relatedness need satisfaction were low, but that the positive relation between competence need satisfaction and vitality was weaker when levels of autonomy need satisfaction were low. Chang (2012) reported a similar effect in relation to leisure activities. Although Sheldon and Filak (2008) failed to replicate these results, Dysvik et al. (2013) similarly noted that: (a) competence and relatedness needs satisfaction was positively associated with intrinsic motivation only when the satisfaction of the need for autonomy was high; and (b) competence need satisfaction positively predicted intrinsic motivation only when relatedness need satisfaction was low. Finally, Sheldon and Niemiec (2006) reported positive associations between need balance and undergraduate university students' intrinsic motivation. Dysvik et al. (2013) reported similar effects of need balance in the prediction of workers' intrinsic motivation, but noted that need balance did not account for any additional variance in intrinsic motivation once the effects of need satisfaction levels and of their interactions were taken into account.

When considering these results, one should keep in mind that these studies relied on an indirect measurement of need balance via the calculation of difference scores. Differences scores have often been criticized for their high level of sensitivity to random measurement errors (Edwards, 2002). An additional flaw of the approach taken by Dysvik et al. (2013) for contrasting interaction and balance effects comes from their addition of the difference scores reflecting need balance to a regression equation already including interactions, which already incorporate an implicit representation of balance effects (e.g., Cheung, 2009; Edwards, 2009). This statistical redundancy could explain Dysvik et al.'s (2013) observation of the limited added-value of balance effects. Interestingly, recent research on the structure of need satisfaction suggests that a more direct measure of need balance is possible.

More precisely, despite the well-established conceptually differentiated nature of the three basic needs for relatedness, competence, and autonomy, research shows that the degree to which all three needs are satisfied tends to be moderately inter-correlated (e.g., Jang et al., 2009; Vansteenkiste et al., 2006). This observation has led some researchers to conduct more extensive investigations of the measurement underpinnings of need satisfaction ratings. This new examination has revealed ratings of need satisfaction to simultaneously reflect respondents' global levels of need satisfaction across all three needs as well as the more specific satisfaction of their needs for relatedness, competence, and autonomy left unexplained by this global level. This conclusion appears to hold in the educational (Garn, Morin, & Lonsdale, 2019; Gillet et al., 2019), general life (Tóth-Király, Morin, Bóthe, Orosz, & Rigó, 2018), sport (Brunet, Gunnell, Teixeira, Sabiston, & Bélanger, 2016), and

work (Bidee, Vantilborgh, Pepermans, Griep, & Hofmans, 2016; Sánchez-Oliva et al., 2017) domains. In practical terms, these studies show that it is possible to simultaneously obtain a direct estimate of participants' global need satisfaction levels encompassing all three needs, together with a non-redundant estimate of the unique satisfaction of each specific need over and above that global level (i.e., expressed as deviations from that global level, and thus providing a direct estimate of imbalance in the extent to which each need is satisfied relative to the other needs for a specific individual). Importantly, research in which these two layers of measurement cannot be disentangled risks leading to an overly similar assessment of the relative contribution of each psychological need, making it difficult to obtain a clear estimate of the unique contribution of each need over that of global need satisfaction levels (e.g., Sánchez-Oliva et al., 2017). We adopt this approach in the present study.

NEED SATISFACTION PROFILES

All previously reviewed studies have relied on a *variable-centered* approach, which focuses on average associations observed between sets of variables in the sample under study. Through its focus on average relations, the variable-centered approach generally fails to consider the possible existence of subpopulations of participants characterized by different types of relations among the variables under investigation. Variable-centered tests of interactions make it possible to verify whether some specific variable relations differ as a function of scores on another variable. However, such tests assume that the interactive effect applies equally to all participants. An even more direct way of looking at the combined effects of need satisfaction involves *person-centered* analyses, specifically designed to test for the presence of distinct students' profiles characterized by different configurations of need satisfaction components (Meyer & Morin, 2016). Person-centered analyses seek to identify qualitatively distinct subpopulations characterized by a similar configuration (or profile) of need satisfaction (Meyer & Morin, 2016; Morin & Wang, 2016).

No study has so far relied on a person-centered approach to study multidimensional profiles of need satisfaction in the education area. It is important to mention, however, previous studies conducted outside of the education area. Thus, in a study conducted in the context of geriatric care units, Souesme, Martinent, and Ferrand (2016) identified three need satisfaction profiles among patients: (a) one profile characterized by low levels of autonomy and competence needs satisfaction, and moderate levels of relatedness need satisfaction (low-moderate satisfaction profile), (b) one profile characterized by high levels of relatedness need satisfaction, and moderate levels

of autonomy and competence needs satisfaction (high-moderate satisfaction profile), and (c) one profile characterized by high levels of autonomy, competence, and relatedness needs satisfaction (high satisfaction profile). Ferrand, Martinent, and Charry (2015) similarly found three need satisfaction profiles among hospitalized elderly people: (a) a high satisfaction profile, (b) a profile characterized by high levels of autonomy and competence needs satisfaction, and moderate levels of relatedness need satisfaction, and (c) a profile characterized by low levels of autonomy, competence, and relatedness needs satisfaction. Finally, in a broader study focusing on both need satisfaction and frustration in the general life domain, Tóth-Király, Bóthe, Orosz, and Rigó (2018b) identified four profiles of need fulfillment characterized by different levels of need satisfaction and frustration toward life in general. Despite the broader scope of this study in which participants' levels of need satisfaction and frustration were considered, the identified profiles also shared similarities with those identified in the geriatric context revealing either a high level of satisfaction across all needs, a high level of frustration across all needs, a moderate level of satisfaction and frustration across all needs, or an imbalanced profile mainly characterized by relatedness need satisfaction.

In the educational context, Gillet et al. (2019) examined the evolution of longitudinal trajectories of global need satisfaction levels among a sample of university students followed over the course of a semester. Their results, despite focusing on a single global dimension of need satisfaction, revealed that students' global need satisfaction trajectories were best characterized by three distinct profiles presenting initially moderate levels that tended to increase over the course of the semester, initially moderate levels that tended to decrease over the course of the semester, and low levels that showed further decreases over the course of the semester. The present study was designed to build, among a new and independent sample of students, on these initial results in providing a more complete multidimensional perspective on the nature of students' multidimensional need satisfaction profiles in the educational context and their evolution over the course of a semester.

Of direct relevance to the present investigation, Morin, Boudrias et al. (2016, 2017) showed that when global constructs are known to co-exist with more specific constructs measured from the same indicators, person-centered analyses conducted while ignoring this global tendency were likely to artificially result in the estimation of profiles characterized by matching levels across indicators even when the true underlying set of profiles presents much clearer shape-related differences. This observation has led Morin, Boudrias et al. (2016, 2017) to note that, whenever this is the case, person-centered analyses should be directly estimated on the basis of indicators providing a proper disaggregation of these global (i.e., global levels of need satisfaction,

reflecting need balance) and specific (i.e., unique levels of satisfaction of each need, reflecting need imbalance) components. In the present research, our first goal is to identify academic need satisfaction profiles in the educational context among a sample of first-year university students, while relying on a proper disaggregation of these two components. In the absence of prior studies relying on a multidimensional (properly disaggregated) person-centered investigation of students' need satisfaction profiles, hypotheses are hard to formulate. Yet, Gillet et al.'s (2019) results, as well as limited research conducted in other research areas (e.g., Ferrand et al., 2015; Souesme et al., 2016; Tóth-Király et al., 2018b), allow us to expect a relatively limited number of profiles (i.e., three to five).

Perfectionism and Need Satisfaction Profiles

A second goal of the present research is to document possible antecedents of students' need satisfaction profiles in the educational context by considering the role of two facets of perfectionism (Hewitt & Flett, 1991). Socially prescribed perfectionism refers to students' beliefs that others uphold high standards about them, and that they will only value them if they are able to meet these standards. Conversely, self-oriented perfectionism refers to students' own adherence to exceedingly high personal standards, often coupled with a high level of self-criticism. Past studies showed that students' personality traits (e.g., conscientiousness, agreeableness) presented statistically significant associations with their level of psychological need satisfaction (Demirbaş-Çelik & Keklik, 2019; Sulea et al., 2015). However, despite the well-documented importance of perfectionism in education (Bong, Hwang, Noh, & Kim, 2014), no variable- or person-centered research has yet looked at the possible relations between students' levels of socially prescribed and self-oriented perfectionism and their levels of need satisfaction. Nevertheless, some research has looked at the effects of these two dimensions of perfectionism on conceptually related constructs, namely autonomous and controlled motivations, which are assumed to be intimately related to the degree of satisfaction of the three needs considered here (Deci & Ryan, 2000).

Self-oriented perfectionists set high goals for themselves and invest substantial efforts in their attempts to achieve those goals (Hewitt & Flett, 1991). This form of perfectionism thus tends to involve higher levels of personal control (Mallinson & Hill, 2011), a component of competence and autonomy needs satisfaction. Likewise, the autonomous pursuit of challenging goals also fosters the development of self-efficacy (Bandura, 1997; Locke & Latham, 2002), a construct akin to competence need satisfaction. It thus appears logical to expect students characterized by strong self-referenced standards and a strong drive for perfection and improvement to display a

higher level of psychological need satisfaction and autonomous motivation. In fact, research supports the idea that self-perfectionists display more autonomous motivation toward school (Harvey et al., 2015; Miquelon, Vallerand, Grouzet, & Cardinal, 2005), more autonomously driven motivational profiles (Gillet, Morin, & Reeve, 2017), and higher levels of interpersonal adjustment (Hill, Zrull, & Turlington, 1997).

In contrast, students characterized by socially prescribed perfectionism tend to be motivated by a desire to approach rewards while avoiding punishments, and present a self-system that is less directly impacted by their school activities (Gaudreau, Franche, & Gareau, 2016). This second form of perfectionism can thus be seen as externalized or non-internalized because students with high levels pursue school activities mainly to respond to perceived social pressure (Gaudreau & Thompson, 2010). Socially prescribed perfectionism entails externally driven standards that are typically seen as hard to modify or control (low autonomy need satisfaction), negative self-evaluative tendencies (low competence need satisfaction), and feelings of exposure to external pressures in order to avoid social rejection (low relatedness need satisfaction; Mallinson & Hill, 2011). In support of these assertions, research generally reveals negative relations between socially prescribed perfectionism, self-efficacy (Mills & Blankstein, 2000; Van Yperen, 2006), and more controlled forms of motivation (Miquelon et al., 2005; Stoeber, Feast, & Hayward, 2009).

These theoretical considerations and indirect sources of research evidence lead us to expect self-oriented perfectionism to display positive associations with students' likelihood of membership into profiles characterized by high levels of psychological need satisfaction in the educational context. Similarly, we also hypothesized positive associations between socially prescribed perfectionism and students' likelihood of membership into profiles characterized by low levels of need satisfaction.

Educational Outcomes of Need Satisfaction Profiles

A third goal of this research is to consider the practical relevance of the need satisfaction profiles by an investigation of their relations with a series of educational outcomes. In accordance with SDT (Deci & Ryan, 2000), Ratelle and Duchesne (2014) found that students with high and increasing levels of relatedness, competence, and autonomy needs satisfaction tended to report a more positive school adjustment. However, conclusions regarding the relative importance of each need in the prediction of outcomes is not as clear. For instance, according to Sheldon and Niemiec's (2006) results, moderate levels of autonomy need satisfaction may not necessarily be harmful when combined with equivalently moderate levels of competence and relatedness

needs satisfaction among undergraduate university students. In addition, autonomy need satisfaction appears to be less strongly related to well-being when relatedness need satisfaction is high (Vansteenkiste et al., 2006). Finally, numerous studies (e.g., Jang et al., 2009; Kashdan, Mishra, Breen, & Froh, 2009) reported differentiated relations between each need and various educational outcomes among university students, and showed that the functional significance of the need for competence could be greater than that of the other needs (i.e., autonomy and relatedness).

In sum, it seems that we can expect students' need satisfaction profiles in the educational context to display a well-differentiated pattern of associations with various educational outcomes. Thus, a profile demonstrating a globally high level of need satisfaction should result in the most desirable outcome levels, while a profile displaying low global levels of need satisfaction should result in the lowest levels of emotional and behavioral outcomes (Gillet et al., 2019; Ratelle & Duchesne, 2014). Based on prior research conducted among university students (Sheldon & Niemiec, 2006), we can also expect a profile displaying a mixture of high and low scores on different needs to be associated with less desirable outcomes than a profile characterized by moderate levels of psychological need satisfaction.

In this research, we consider the key educational outcomes of students' interest toward their studies, class attendance, and educational satisfaction given extensive empirical evidence of their role in academic success (e.g., Morrissey, Hutchison, & Winsler, 2014; Tosto, Asbury, Mazzocco, Petrill, & Kovas, 2016). Students' class attendance plays an important role in higher education, and has often been shown to be an important predictor of academic achievement (e.g., Silvestri, 2003). Attending classes makes it more likely for students to benefit from richer exchanges with the teacher and other students, and to benefit from an enriched exposure to the course material. These observations have led many universities to devise attendance policies, assuming that greater attendance will help students to reap greater benefits from their learning experiences. Moreover, educational satisfaction is an important outcome to consider given its influence on students' decisions to continue with, or drop out of, a course (e.g., Sinclair, 2014). Satisfaction is also related to higher levels of academic performance, to the decision to enroll in additional classes, and to students' subjective assessments of their own well-being (Cummins & Tomy, 2011). Similarly, students' levels of interest toward their studies represents another well-documented predictor of academic achievement, engagement, and persistence, as well as of positive affect (e.g., Gillet, Vallerand, Lafrenière, & Bureau, 2013).

Finally, throughout the world, university entry is highly prized with a large number of applicants competing for a limited number of places. Although rates of student retention differ greatly across sectors, every year students

leave university either by choice or necessity (Maher et al., 2013). For instance, although cautious rates of dropout from higher education programs of 6.2 percent for the UK (Higher Education Statistics Agency, 2017) and 16 percent for Canada (Shaienks, Gluszynski, & Bayard, 2008) have been reported, the Organization for Economic Co-Operation and Development (OECD, 2017) reports an average dropout rate of 32 percent across 18 OECD countries. Persistence and dropout are critical outcomes for educational systems worldwide, and are associated with critically important psychological, social, and economic consequences for both the students and the society as a whole (Voelkle & Sander, 2008). In addition, a high rate of attrition can affect the reputation of the university itself, or even of a whole country as a provider of quality higher education, and may have financial consequences at the university and country levels. Dropout has also considerable financial, social, and emotional consequences for the students, and can be associated with distress, reduced professional opportunities, and increased levels of criminality (Bjerk, 2012; OECD, 2017). We thus also consider dropout intentions as one of the key predictors of school dropout behavior (Bjerk, 2012).

Stability and Change in Need Satisfaction Profiles

A last goal of this research is to assess the stability of students' need satisfaction profiles in the educational context over the course of a university semester (i.e., corresponding in France to a period of roughly 12 weeks). Although past longitudinal investigations suggest that need satisfaction profiles should exhibit some stability, they also suggest that change is possible over the course of a few months, and more likely among a sample of university students (Cheon et al., 2016; Cox, Smith, & Williams, 2008; Ratelle & Duchesne, 2014; Wandeler & Bundick, 2011). For instance, Gillet et al. (2019) found that a period of 10 weeks was sufficient to identify evolutions in longitudinal trajectories of global need satisfaction levels among a sample of university students.

As noted by Meyer and Morin (2016; also see Meyer, Morin, & Wasti, 2018), it is critical to ascertain the stability of person-centered solutions in order to be able to support their utilization as guides for the development of intervention strategies tailored at distinct types, or profiles, of students. Two distinct forms of longitudinal stability can, and should, be considered (Gillet, Morin, & Reeve, 2017; Kam et al., 2016). A first form of longitudinal stability, within-sample stability, is related to the nature of the profiles themselves, which could change over time. For example, the number or structure of the profiles could change over time, which would suggest that the profiles have limited usefulness as intervention guides as they reflect a highly transient phenomenon, or that the sample under consideration has recently been exposed to some rather important internal or external changes. Morin,

Meyer, Creusier, and Biétry (2016) refer to these two subtypes of within-sample profile stability as configural (same number of profiles) and structural (profiles with the same nature) similarity. In contrast, changing circumstances may lead to a change in the degree of similarity among members of specific profiles (dispersion similarity), or in the relative size of the profiles (distributional similarity). These two subtypes of within-sample profile stability do not preclude the reliance on person-centered solutions as intervention guides, but simply suggest that the identified profiles show some degree of reactivity to internal or external changes.

A second form of longitudinal stability, within-person stability, is related to changes in the degree to which students correspond to specific profiles over time (Gillet, Morin, & Reeve, 2017; Kam et al., 2016) and can be observed in the absence of within-sample changes. For example, observing an average increase in levels of global need satisfaction at the sample level could alternatively be explained, at the profile level, by: (a) increases in the size of profiles presenting higher levels of global need satisfaction (within-sample distributional change); (b) changes in the nature of the profiles so that they become characterized by higher levels of global need satisfaction (within-sample structural change); and (c) a higher tendency for students to transition to profiles displaying greater levels of global need satisfaction (within-person change). Naturally, (c) could be a cause of (a). However, (a) could also happen due to the accumulation of multiple non-systematic transition patterns leading to changes in the size of multiple profiles.

To date, most research on need satisfaction has been cross-sectional in nature, and no research has yet looked at the critical issue of profile stability. Within a person-centered perspective, a single study has examined whether students' need satisfaction levels remained stable or fluctuated over time, but only considering a single need at a time (Ratelle & Duchesne, 2014). Prior variable-centered studies showed that psychological need satisfaction tends to display lower levels of rank-order stability in samples of more advanced students (vocational training, university) than at lower levels of education when children tend to experience more stable environments (Cheon et al., 2016; Cox et al., 2008). For instance, in a 3-year longitudinal study (with annual measurements) of 414 trainees, Wandeler and Bundick (2011) found need satisfaction to be only moderately stable over one-year intervals ($r = 0.33$ to 0.49). In contrast, higher levels of rank-order stability were reported over a period of 7 months by Marchand and Skinner (2007) among a sample of children ($r = 0.49$ to 0.67). Importantly, the freshman year is known to be accompanied with multiple major changes involving all facets of students' lifestyles and educational habits (e.g., moving to a new city, moving out of the parental house, starting part-time work activities, new peer groups—De Clercq, Galand, & Frenay, 2017; Perry, Hladkyj, Pekrun, & Pelletier, 2001).

Such important transformations are likely to impact students' need satisfaction in a way that might explain the lower levels of stability observed in this population.

Given that the first university semester provides freshman students with the occasion to integrate these various transitions and to become familiarized with university functioning and expectations, we decided to focus on this specific period. What remains unclear, however, is how and to what extent these previous results, all emerging from variable-centered studies, would translate to a person-centered perspective. For this reason, we leave open the question of whether, and to what extent, the identified need satisfaction profiles would display stability or change over the course of a university semester. Yet, on the basis of previous research evidence, we expect the profiles characterized by higher levels of need satisfaction in the educational context to display higher levels of stability over time (Gillet et al., 2019; Ratelle & Duchesne, 2014).

METHOD

Participants and Procedure

A convenience sample of 521 first-year undergraduate university students enrolled in a French university ($M_{age} = 18.95$; $SD = 2.06$; 101 males, 420 females) agreed to participate in this study via informed consent procedures. Two weeks after the beginning of the fall semester, these participants completed a first set of self-reported questionnaires in classroom settings (15 minutes). Of those, 423 (81.2%) also agreed to complete the same self-reported measures 10 weeks later (Time 2) near the end of the semester. Each time, the purpose of the study was explained to the participants, who were guaranteed confidentiality, and reassured that they were entirely free to participate or not without any consequence. Due to the longitudinal nature of the study, participants were also asked to provide a personal identification code of their own choosing on their questionnaire in order to make it possible to link their responses across time points. Due to its non-interventional and non-invasive nature, this study was found exempt by our research ethics committee. All measures were administered in French. Questionnaires that were not already validated in this language were adapted to French by a panel of experts according to a standardized back-translation procedure (Hambleton, 2005; van de Vijver & Hambleton, 1996).

Measures

Need Satisfaction. Need satisfaction levels were measured using a questionnaire developed by Gillet and colleagues (Gillet, Fouquereau, Huyghebaert, & Colombat, 2016; Gillet, Rosnet, & Vallerand, 2008). For the

purpose of this study, this nine-item questionnaire was minimally adapted to match the educational context. This questionnaire measures the satisfaction of students' basic psychological needs for relatedness (three items; e.g., "I have a lot of sympathy for the persons with whom I interact"; Time 1 $\alpha = 0.69$; Time 2 $\alpha = 0.75$), competence (3 items; e.g., "Often, I feel that I am very efficient"; Time 1 $\alpha = 0.73$; Time 2 $\alpha = 0.81$), and autonomy (3 items; e.g., "Generally, I feel free to express my ideas and opinions"; Time 1 $\alpha^1 = 0.54$; Time 2 $\alpha = 0.79$). All items are rated on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree).

Perfectionism (Predictor). Self-oriented (three items; e.g., "I am perfectionistic in setting my goals"; Time 1 $\alpha = 0.86$; Time 2 $\alpha = 0.90$) and socially prescribed (three items; e.g., "My family expects me to be perfect"; Time 1 $\alpha = 0.77$; Time 2 $\alpha = 0.84$) perfectionism was assessed using the short form of the Multidimensional Perfectionism Scale (Cox, Enns, & Clara, 2002; Hewitt & Flett, 1991). All items are rated on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree).

Satisfaction (Outcome). Educational satisfaction was assessed with a single item measure (Gillet, Huyghebaert et al., 2017; Shimazu, Schaufeli, Kamiyama, & Kawakami, 2015) asking students to report the extent to which they were satisfied with their undergraduate courses using a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree).

Interest (Outcome). Five items taken from the Intrinsic Motivation Inventory (McAuley, Duncan, & Tammen, 1989; e.g., "I would describe my classes as very interesting"; Time 1 $\alpha = 0.86$; Time 2 $\alpha = 0.91$) were used to assess participants' interest toward their studies. Responses are given on a 1 (strongly disagree) to 7 (strongly agree) Likert scale.

¹ Although we report scale score reliability estimates based on Cronbach alpha (α) associated with each of our measures in this section, more precise model based composite reliability coefficients (Dunn, Baguley, & Brunsdn, 2014; Morin, Myers, & Lee, 2020) are reported in the preliminary analysis section. These omega (ω ; McDonald, 1970) coefficients were calculated from the absolute values of the standardized factors loadings ($|\lambda_i|$) and item uniquenesses (δ_i) taken from preliminary measurement models as:

$$\omega = \frac{(\sum |\lambda_i|)^2}{[(\sum |\lambda_i|)^2 + \sum \delta_i]}$$

Dropout Intentions (Outcome). Dropout intentions were captured using a three-item subscale created by combining two items previously used by Gillet, Berjot, Vallerand, and Amoura (2012; i.e., “I often intend to drop out of my studies” and “I am determined to pursue my college education”—reversed) with a single item previously used by Vallerand, Fortier, and Guay (1997; i.e., “I intend to drop out of university”). This three-item (Time 1 $\alpha = 0.89$; Time 2 $\alpha = 0.95$) combination was previously validated in French by Gillet, Huyghebaert et al. (2017). These items are rated on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree).

Class Attendance (Outcome). Participants' self-reported their class attendance level over the course of the semester on a 6-point Likert-type scale (1 = 0% to 6 = 100%).

ANALYSES

Overview of the Analytic Procedures

Given the complexity of the analytical procedures utilized in the present study, we first provide a global overview of the main analytical steps, which we will then present in turn, that we followed in this study. First, in order to achieve a proper disaggregation of the global and specific components of the need satisfaction measures, as well as to verify the psychometric properties of all measures used in the present study and their measurement invariance over time, we conducted a series of preliminary measurement analyses to be described shortly. Factor scores were extracted from these analyses to serve as input for the main person-centered analyses in order to ensure that the various variable indicators used in this study retained the properties of the underlying measurement models estimated (bifactor structure, invariance, partial correction for measurement errors). Second, after briefly presenting the model estimation procedures utilized in the present study, latent profile analyses (LPA) were conducted in order to estimate the number of profiles required to reflect participants' need satisfaction configurations at each time point. Third, the two LPA solutions (one per time point) were combined into a single longitudinal model to verify the similarity of the profiles estimated over time. Fourth, the retained longitudinal LPA solution was converted to a latent transition analytic (LTA) model to estimate the within-person stability in profile membership. Fifth, predictors and outcomes were incorporated to the model.

This combination of advanced statistical procedures is likely to be unfamiliar, at the present time, for most readers. We refer readers interested at implementing similar analyses to the following user friendly introductions,

which also include comprehensive sets of annotated analytic syntax. First, Morin, Boudrias et al. (2016, 2017) present an extensive introduction to the logic and estimation of LPA starting from indicators taken from preliminary bifactor measurement models in order to achieve a proper disaggregation of global versus specific ratings. Second, Morin and Litalien (2019) provide a very comprehensive introduction to person-centered analyses covering LPA, LTA, longitudinal tests of profile similarity, and covariate inclusion.

Preliminary Analyses

The psychometric properties of all measures were verified in a series of preliminary factor analyses realized using Mplus 7.4 (Muthén & Muthén, 2015). The main analyses conducted in the present study relied on longitudinally invariant factor scores (Millsap, 2011) saved from these preliminary models in standardized units ($M = 0$, $SD = 1$). When compared to scale scores created by simply averaging items, factor scores have the advantage of providing a partial control for measurement errors by giving more weight to more reliable items (Skrondal & Laake, 2001), of preserving more accurately the structure of the initial measurement models, and of ensuring comparability across time waves (e.g., measurement invariance). Readers interested in a more extensive discussion of the advantages of factor scores in the estimation of LPA are referred to Morin, Boudrias et al. (2016; also see Morin, Meyer et al., 2016).

Bifactor confirmatory factor analytic (CFA) models (e.g., Holzinger & Swineford, 1937) were utilized to represent the measurement structure for the need satisfaction variables. This decision is predicated on evidence from recent studies demonstrating the superiority of a bifactor representation for need satisfaction ratings based on SDT (Sánchez-Oliva et al., 2017; Tóth-Király, Morin et al., 2018). More precisely, these studies demonstrated how a bifactor model could be used to obtain a direct estimate of participants' global level of satisfaction across all needs, while also providing a direct estimate of the meaningful specificities (or imbalance) remaining in each of the specific needs. In these bifactor models, all need satisfaction items associated with the three subscales were used to define an overarching G-factor reflecting participants' global need satisfaction levels. Furthermore, all subscale-specific items were used to define an S-factor representing the unique variance associated with each need left unexplained by the G-factor (i.e., expressed as deviations from the global level). As noted in the online supplements, the bifactor model resulted in the estimation of a global need satisfaction factor that was well defined ($\omega_{11} = 0.794$; $\omega_{12} = 0.824$), and of equally well-defined specific need satisfaction factors for competence ($\omega_{11-2} = 0.679$) and relatedness ($\omega_{11} = 0.692$; $\omega_{12} = 0.719$). However, these results showed that, once the variance explained by the G-factor was taken into account, there remained

no meaningful specificity located at the level of the specific autonomy factor ($\omega_{t1} = 0.025$; $\omega_{t2} = 0.036$). As noted in the online supplements, this specific result was expected, and simply suggested that, among this specific sample of students, levels of autonomy need satisfaction were systematically found to be in balance, or alignment, with that of the other needs. As such, profiles will be estimated based on factor scores reflecting global need satisfaction (defined by all autonomy, competence, and relatedness items), specific competence satisfaction (defined from the competence items as the variance in competence need satisfaction left unexplained by the G-factor), and specific relatedness satisfaction (defined from the relatedness items as the variance in relatedness need satisfaction left unexplained by the G-factor). Although factor scores related to the specific autonomy satisfaction factor (defined from the autonomy items as the variance in autonomy need satisfaction left unexplained by the G-factor) were also saved as part of this process, they were simply not used in the following analyses due to very low level of composite reliability.

Results from all preliminary models, their invariance, and variable correlations are reported in the online supplements (pages S2 to S15). As shown in these supplements, composite reliability estimates for the multi-item predictors and outcomes proved to be fully equivalent across time points and equally satisfactory: Students' interest toward their studies $\omega = 0.891$; dropout intentions $\omega = 0.923$; socially prescribed perfectionism $\omega = 0.823$; and self-oriented perfectionism $\omega = 0.876$.

Model Estimation

All analyses were conducted with Mplus 7.4 (Muthén & Muthén, 2015) maximum likelihood robust (MLR) estimator and Full Information Maximum Likelihood (FIML) procedures to manage missing responses (Enders, 2010; Graham, 2009). FIML made it possible to use all respondents who participated in at least one wave of data collection ($N = 521$) in the estimation of longitudinal models, without having to resort to a problematic listwise deletion strategy limited to respondents having participated in both waves ($N = 423$). When respondents were compared as a function of having completed both time waves or only the first one on all baseline measures, very few statistically significant differences emerged. These comparisons are reported in Table S7 of the online supplements and only showed that slightly more males ($p \leq .01$) were lost through attrition, and that students lost through attrition tended to present slightly lower levels of class attendance ($p \leq .01$) and interest toward their studies ($p \leq .05$). FIML has been shown to perform as well as multiple imputation, even in the presence of large amounts of missing data (Enders, 2010; Graham, 2009; Jeličić, Phelps, & Lerner, 2009; Larsen,

2011). We note that FIML relies on missing at random (MAR) assumptions, making it robust to the presence of differences between participants related to attrition on any of the variables included in the model. Indeed, MAR allows missing responses to be conditioned on all variables included in the model (Enders, 2010; Graham, 2009).

Time-Specific Latent Profile Analyses (LPA)

Time-specific LPA solutions including one to eight latent profiles were first estimated using the need satisfaction factors as profile indicators. These initial analyses aimed to verify whether each time-specific solution would result in the identification of the same number of profiles. In each of these solutions, the profiles were defined while allowing for the free estimation of the means and variances of the indicators across profiles (Diallo, Morin, & Lu, 2016; Peugh & Fan, 2013). These analyses were conducted using 5,000 sets of random start values (with 1,000 iterations), and allowing the best 200 solutions to be retained for final optimization (Hipp & Bauer, 2006; McLachlan & Peel, 2000). In the more complex longitudinal models to be described shortly, these values were increased to 10,000 (2,000), and 500. Information on model comparison procedures used to select the optimal time-specific solution as well as for tests of profile similarity are provided in the online supplements (pages S17 to S24).

Longitudinal Tests of Profile Similarity

The optimal time-specific LPA solutions were integrated into a longitudinal LPA model. This model served as the baseline for the realization of systematic tests of profile similarity over time (Morin & Litalien, 2017; Morin, Meyer et al., 2016). These tests were conducted according to the following sequence: (a) configural similarity, which refers to the identification of the same number of profiles across time points; (b) structural similarity, which refers to the estimation of profiles having the same shape (i.e., within-profile means) across time waves; (c) dispersion similarity, which refers to the estimation of profiles characterized by the same level of within-profile variability across time waves; and (d) distributional similarity, which refers to the estimation of profiles having the same relative size across time points.

Latent Transition Analyses (LTA)

The most similar longitudinal LPA solution was converted to a LTA (Collins & Lanza, 2010) to investigate within-person stability and change in profile membership (Kam et al., 2016). This conversion was then used as a new baseline to investigate the predictive (relations with predictors) and

explanatory (relations with outcomes) similarity of the profiles across time points. This conversion was done using the manual auxiliary three-step approach (Asparouhov & Muthén, 2014; McLarnon & O'Neill, 2018) following the procedures outlined by Morin and Litalien (2017) for the LTA context.

Predictors and Outcomes of Profile Membership

The relations between predictors (self-oriented perfectionism, socially prescribed perfectionism, and sex) and profile membership were assessed using a multinomial logistic regression link function. The predictors were directly integrated into the LTA model and used to predict participants' likelihood of profile membership. Following the procedures advocated by Gillet, Morin, and Reeve (2017) in their study of the associations between perfectionism and motivational profiles, sex was allowed to predict the profiles at both time waves as a time-invariant controlled variable. This decision was predicated on the well-documented associations between sex, need satisfaction levels (Hollembek & Amorose, 2005), and perfectionism (Shanmugam & Davies, 2015). This control was made particularly important given the specific composition of our sample, including a majority of females (80.6%), in order to ensure that estimated relations would not be an artifact of sex.

In contrast, repeated measures of perfectionism were specified as related to membership into the profiles estimated at the same time point (i.e., perfectionism at Time 1 predicted profile membership at Time 1, etc.). We contrasted three alternative models (Ciarrochi, Morin, Sahdra, Litalien, & Parker, 2017; Gillet, Morin, & Reeve, 2017). In a first model, associations between the predictors and the profiles were estimated freely across time waves (i.e., the effects were allowed to change/differ over time), and the effects of the predictors on Time 2 profile membership were allowed to differ as a function of Time 1 profile membership (i.e., the predictors were allowed to predict specific profile-to-profile transitions). In a second model, associations between the predictors and the profiles were estimated freely across time waves (i.e., the effects were allowed to change/differ over time), but not across Time 1 profiles (i.e., the effects of predictors on profile membership were independent of profile membership at the previous time wave). A third model tested the predictive similarity of these relations by constraining the associations between the predictors and the profiles to be equal across time waves.

Finally, explanatory similarity was assessed by incorporating outcomes into the final LTA. Time-varying measures of the outcomes (dropout intentions, interest toward studies, satisfaction, and class attendance) were first allowed to differ across profiles and time waves. The explanatory similarity of these relations was then tested by constraining the within-profile means of these outcomes to be equal across time waves. Mplus's MODEL CONSTRAINT

function, which relies on the multivariate delta method (Kam et al., 2016; Raykov & Marcoulides, 2004), was used to assess mean-level differences across profiles. Given the complexity of the models estimated here, it was not possible to simultaneously integrate predictors and outcomes into the same model. For this reason, predictors and outcomes were separately integrated (in two distinct analyses) into the final model of profile similarity. However, it must be noted that all of these models simultaneously included predictor or outcome measures taken at the two time points, so that the effects of Time 2 predictors can be considered to be controlled for Time 1 predictor measures, and the relations between profile membership and Time 2 outcomes can also be considered to be controlled for Time 1 outcome levels.

RESULTS

Determination of the Number of Profiles and Longitudinal Tests of Profile Similarity

The procedures used to determine the optimal time specific LPA solutions, as well as for tests of profile similarity are fully reported in the online supplements (pages S17 to S24) and converged on a five-profile solution at both time waves, thus evidencing configural similarity. This solution presents a moderately high classification accuracy, as captured by an entropy (an indicator of classification accuracy ranging from 0 to 1) value of 0.775 at Time 1 and 0.730 at Time 2. The results from the longitudinal LPA built from these two time-specific LPA solutions similarly provided evidence for the structural, dispersion, and distributional similarity of our solution.

Interpretation of the Final Profile Solution

The final retained model of distributional similarity is graphically represented in Figure 1 (exact within-profile means are reported in Table S10 of the online supplements), and served as the baseline for all upcoming analyses. Profiles 1 and 2 are both characterized by close to average levels of satisfaction of their specific needs for competence and relatedness. However, Profile 2 also presents average levels of global need satisfaction, whereas Profile 1 presents high levels of global need satisfaction. In the interpretation of these profiles, it is important to keep in mind that whereas scores on the global need satisfaction factors reflect participants' global levels of need satisfaction across all three needs, the specific factors reflect positive (higher levels) or negative (lower levels) imbalance in the satisfaction of the specific needs for relatedness, competence, and autonomy. Thus, which average scores on the specific factors, these two profiles can be considered to display a balanced level of need satisfaction (i.e., no evidence of imbalance). As such, Profile 1, which

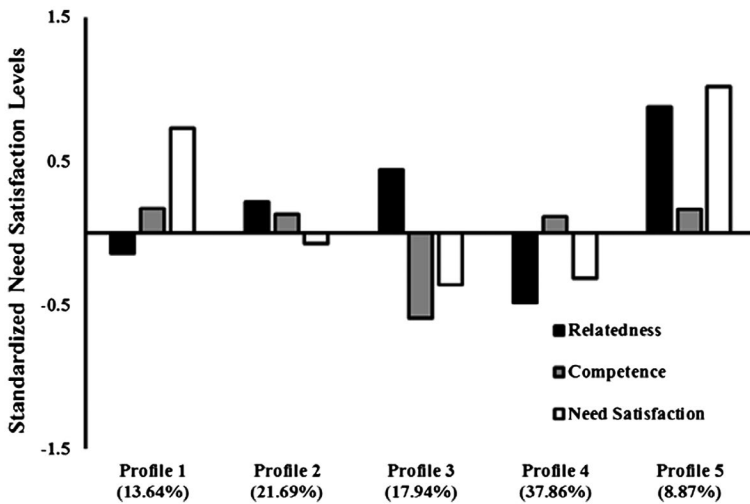


FIGURE 1. Five-profile solution. *Note.* Profile 1: Globally Satisfied; Profile 2: Moderately Satisfied; Profile 3: Globally Dissatisfied, Highly Connected, and Competence Deficient; Profile 4: Globally Dissatisfied and Relatedness Deficient; Profile 5: Globally Satisfied and Highly Connected; Profile indicators are factor scores with a mean of 0 and a standard deviation of 1.

represents 13.64 percent of the sample, was labelled “*Globally Satisfied*”. In contrast, the slightly larger (21.69%) Profile 2 was labelled “*Moderately Satisfied*”. Profile 3 presents moderately low levels of global need satisfaction, accompanied by moderately high specific levels of relatedness need satisfaction (positive imbalance) and moderately low specific levels of competence need satisfaction (negative imbalance). This “*Globally Dissatisfied, Highly Connected, and Competence Deficient*” profile characterizes 17.94 percent of the respondents. Conversely, Profile 4 presents moderately low levels of global need satisfaction, coupled with moderately low specific levels of relatedness need satisfaction (negative imbalance), and average (i.e., balanced) specific levels of competence need satisfaction. This “*Globally Dissatisfied and Relatedness Deficient*” profile is the largest (37.86%). Finally, Profile 5 presents high levels of global need satisfaction associated with high specific levels of relatedness need satisfaction (positive imbalance) and average (i.e., balanced) specific levels of competence need satisfaction. This “*Globally Satisfied and Highly Connected*” profile is the smallest, corresponding to 8.87 percent of the respondents.

Latent Transitions

The transition probabilities associated with the LTA model build from this final model of distributional similarity are reported in Table 1. Membership into Profiles 3 (*Globally Dissatisfied, Highly Connected, and Competence Deficient*; stability of 99.0%) and 4 (*Globally Dissatisfied and Relatedness Deficient*; 97.8%) are the most stable. Similarly, membership into Profiles 1 (*Globally Satisfied*; 65.9%) and 2 (*Moderately Satisfied*; 64.8%) are also relatively stable. Conversely, membership into Profile 5 (*Globally Satisfied and Highly Connected*; 26.1%) displays a high level of instability over time.

Not surprisingly, transitions are rare for participants initially corresponding to Profiles 3 and 4. However, transitions are more frequent for members of the other profiles. When transitions befall members of Profile 1 (*Globally Satisfied*) at Time 1, they primarily involve Profile 2 (*Moderately Satisfied*; 20.1%), although some members of Profile 1 also transition to Profiles 3 (*Globally Dissatisfied, Highly Connected, and Competence Deficient*; 5.4%) or 5 (*Globally Satisfied and Highly Connected*; 8.7%). For members of Profile 2 (*Moderately Satisfied*) at Time 1, the dominant transitions involve Profiles 4 (*Globally Dissatisfied and Relatedness Deficient*; 15.0%) and 5 (*Globally Satisfied and Highly Connected*; 12.4%), although some transitions also occur toward Profile 1 (*Globally Satisfied*; 7.8%). Finally, members of Profile 5 (*Globally Satisfied and Highly Connected*) at Time 1 only transition toward Profiles 1 (*Globally Satisfied*; 30.8%) or 2 (*Moderately Satisfied*; 43.1%) at Time 2.

Predictive Similarity (Predictors)

As noted in the online supplements (see page S18 and Table S9), the results supported the equivalence of the predictions across time periods (predictive

TABLE 1
Size of the Profiles and Transitions Probabilities

	<i>Time 2 Profiles</i>				
	<i>Profile 1</i>	<i>Profile 2</i>	<i>Profile 3</i>	<i>Profile 4</i>	<i>Profile 5</i>
<i>Time 1 Profiles</i>					
Profile 1	0.659	0.201	0.054	0.000	0.087
Profile 2	0.078	0.648	0.000	0.150	0.124
Profile 3	0.010	0.000	0.990	0.000	0.000
Profile 4	0.000	0.022	0.000	0.978	0.000
Profile 5	0.308	0.431	0.000	0.000	0.261

Note: Profile 1: Globally Satisfied; Profile 2: Moderately Satisfied; Profile 3: Globally Dissatisfied, Highly Connected, and Competence Deficient; Profile 4: Globally Dissatisfied and Relatedness Deficient; Profile 5: Globally Satisfied and Highly Connected.

similarity), and a lack of relations between predictors and specific profile transitions. The results from this final predictive model are reported in Table 2.² No statistically significant association was noted between profile membership and participants' sex. Results further revealed that higher levels of self-oriented perfectionism were related to a higher likelihood of membership into Profile 5 (*Globally Satisfied and Highly Connected*) relative to all other profiles, and into Profile 1 (*Globally Satisfied*) relative to Profile 3 (*Globally Dissatisfied, Highly Connected, and Competence Deficient*). In contrast, socially prescribed perfectionism showed an almost exactly opposite pattern of associations with the profiles relative to self-oriented perfectionism. More precisely, socially prescribed perfectionism levels predicted a lower likelihood of membership into Profile 5 (*Globally Satisfied and Highly Connected*) relative to Profiles 2 (*Moderately Satisfied*), 3 (*Globally Dissatisfied, Highly Connected, and Competence Deficient*), and 4 (*Globally Dissatisfied and Relatedness Deficient*), and into Profile 1 (*Globally Satisfied*) relative to Profile 3 (*Globally Dissatisfied, Highly Connected, and Competence Deficient*).

Explanatory Similarity (Outcomes)

As noted in the online supplements (see page S19 and Table S9), the model in which the outcome levels were specified to be equal over time was supported by the data (explanatory similarity). The within-profile means of the outcomes, together with their 95 percent confidence intervals, are reported in Table 3, and graphically illustrated in Figure 2. These results were highly consistent across outcomes, showing the most desirable outcome levels (higher levels of interest toward one's studies, educational satisfaction, and attendance, and the lowest levels of dropout intentions) to be equally associated with Profiles 1 (*Globally Satisfied*) and 5 (*Globally Satisfied and Highly Connected*), followed equally by Profiles 2 (*Moderately Satisfied*) and 4 (*Globally Dissatisfied and Relatedness Deficient*), with the least desirable outcomes observed in Profile 3 (*Globally Dissatisfied, Highly Connected, and Competence Deficient*). However, levels of class attendance were lower in Profile 3 (*Globally Dissatisfied, Highly Connected, and Competence Deficient*) relative to the other profiles, and slightly higher in Profile 5 (*Globally Satisfied and Highly Connected*) relative to Profile 4 (*Globally Dissatisfied and Relatedness Deficient*).

² Models including interactions between sex and perfectionism were also estimated. These models similarly resulted in a conclusion of *predictive* similarity. However, none of the added interactions was statistically significant in the prediction of profile membership.

TABLE 2
Effects of the Predictors on the Likelihood of Profile Membership into the First Listed Profile Relative to the Second Listed One
(Model of Predictive Similarity)

	Coef. (SE)	OR	Coef. (SE)	OR	Coef. (SE)	OR	Coef. (SE)	OR	Coef. (SE)	OR
	<i>Profile 1 vs. Profile 5</i>		<i>Profile 2 vs. Profile 5</i>		<i>Profile 3 vs. Profile 5</i>		<i>Profile 4 vs. Profile 5</i>		<i>Profile 1 vs. Profile 4</i>	
SOP	-0.636 (0.249)**	0.530	-0.802 (0.226)**	0.448	-1.947 (0.686)**	0.143	-0.996 (0.259)**	0.369	0.360 (0.257)	1.434
SPP	0.476 (0.280)	1.609	0.563 (0.266)*	1.756	1.353 (0.520)**	3.869	0.876 (0.279)**	2.402	-0.401 (0.222)	0.970
Sex	0.026 (0.359)	1.027	-0.125 (0.336)	0.883	-0.550 (0.618)	0.577	-0.302 (0.353)	0.740	0.333 (0.369)	1.388
	<i>Profile 2 vs. Profile 4</i>		<i>Profile 3 vs. Profile 4</i>		<i>Profile 1 vs. Profile 3</i>		<i>Profile 2 vs. Profile 3</i>		<i>Profile 1 vs. Profile 2</i>	
SOP	0.194 (0.232)	1.214	-0.951 (0.720)	0.386	1.311 (0.660)*	3.710	1.145 (0.617)	3.141	0.167 (0.216)	1.181
SPP	-0.313 (0.205)	0.731	0.477 (0.496)	1.610	-0.877 (0.442)*	0.416	-0.790 (0.426)	0.454	-0.088 (0.202)	0.916
Sex	0.177 (0.333)	1.193	-0.249 (0.645)	0.780	0.577 (0.587)	1.780	0.426 (0.579)	1.531	0.151 (0.358)	1.163

Note: * $p < .05$; ** $p < .01$; SE: Standard Error of the coefficient; OR: Odds Ratio; SOP: Self-Oriented Perfectionism; SPP: Socially Prescribed Perfectionism. The coefficients and OR reflect the effects of the predictors on the likelihood of membership into the first listed profile relative to the second listed profile. Profile 1: Globally Satisfied; Profile 2: Moderately Satisfied; Profile 3: Globally Dissatisfied, Highly Connected, and Competence Deficient; Profile 4: Globally Dissatisfied and Relatedness Deficient; Profile 5: Globally Satisfied and Highly Connected.

TABLE 3
Outcomes of Profile Membership (Model of Explanatory Similarity)

	Profile 1 M [CI]	Profile 2 M [CI]	Profile 3 M [CI]	Profile 4 M [CI]	Profile 5 M [CI]	Summary of Statistically Significant Differences
Students' interest toward their studies	0.569 [0.454; 0.683]	0.268 [0.109; 0.427]	-1.539 [-1.889; -1.189]	0.081 [-0.080; 0.243]	0.593 [0.428; 0.759]	1 = 5 > 2 = 4 > 3
Satisfaction	5.765 [5.615; 5.916]	5.494 [5.296; 5.692]	3.090 [2.690; 3.489]	5.338 [5.161; 5.516]	5.817 [5.602; 6.031]	1 = 5 > 2 = 4 > 3
Dropout Intentions	-0.460 [-0.556; -0.364]	-0.293 [-0.429; -0.156]	1.737 [1.454; 2.019]	-0.305 [-0.415; -0.195]	-0.553 [-0.625; -0.480]	3 > 2 = 4 > 1 = 5
Class Attendance	95.540 [93.406; 97.675]	94.252 [32.023; 96.481]	46.083 [37.726; 54.439]	93.324 [91.633; 95.015]	96.276 [94.550; 98.002]	3 < 1 = 2 = 4; 1 = 2 = 5; 3 < 4 < 5

Note: M: Mean; CI: 95% Confidence Interval. Indicators of students' interest toward their studies and dropout intentions are factor scores with a mean of 0 and a standard deviation of 1. Profile 1: Globally Satisfied; Profile 2: Moderately Satisfied; Profile 3: Globally Dissatisfied, Highly Connected, and Competence Deficient; Profile 4: Globally Dissatisfied and Relatedness Deficient; Profile 5: Globally Satisfied and Highly Connected.

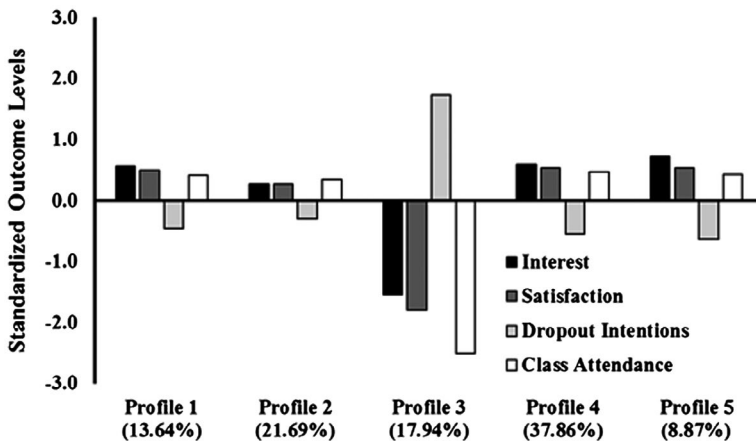


FIGURE 2. Standardized outcome levels for the five-profile solution of explanatory similarity (equal across time points). *Note.* Profile 1: Globally Satisfied; Profile 2: Moderately Satisfied; Profile 3: Globally Dissatisfied, Highly Connected, and Competence Deficient; Profile 4: Globally Dissatisfied and Relatedness Deficient; Profile 5: Globally Satisfied and Highly Connected; Indicators of students' interest toward their studies and dropout intentions are factor scores with a mean of 0 and a standard deviation of 1, whereas those for satisfaction and class attendance were standardized for this figure.

DISCUSSION

Many studies have shown that the satisfaction of the three basic needs for relatedness, competence, and autonomy tended to be moderately to strongly interrelated (e.g., Sheldon & Filak, 2008). Yet, our understanding of how these three needs combine into specific profiles of students remains understudied, particularly in the educational area (e.g., Vansteenkiste et al., 2006). In particular, the value of considering the satisfaction of each specific need, once students' global level of need satisfaction is considered, remains essentially unknown (Sánchez-Oliva et al., 2017). The adoption of a person-centered approach appeared to be naturally suited to this question, as it provided us with a way to assess how global and specific (imbalance) components of need satisfaction in the educational context are most commonly combined for specific profiles of students, and the educational consequences of these profiles.

Characteristics of Students' Need Satisfaction Profiles

Five distinct profiles best reflected the need satisfaction configurations in the educational context of the French university students forming the current sample: (a) *Globally Dissatisfied, Highly Connected, and Competence*

Deficient (moderately low global satisfaction, moderate levels of positive imbalance in specific relatedness satisfaction, and moderate levels of negative imbalance in specific competence need satisfaction); (b) *Globally Satisfied and Highly Connected* (high global satisfaction, high levels of positive imbalance in specific relatedness satisfaction, and no imbalance in specific competence satisfaction); (c) *Globally Satisfied* (high global satisfaction, and no imbalance in specific relatedness and competence satisfaction); (d) *Moderately Satisfied* (average global satisfaction, and no imbalance in specific relatedness and competence satisfaction); and (e) *Globally Dissatisfied and Relatedness Deficient* (moderately low global satisfaction, moderate levels of negative imbalance in specific relatedness satisfaction, and no imbalance in specific competence satisfaction). These profiles support the value of a finer-grained representation of need satisfaction incorporating both the global extent to which all three needs are met, and the specificity associated with each individual need over and above this global level of satisfaction (need imbalance, expressed as deviations from the global level), rather than simply focusing on a global satisfaction score (Vansteenkiste et al., 2006). Still, additional person-centered research is needed to increase the generalizability of our results. For instance, tests of profile similarity (Morin, Meyer et al., 2016) could also be used to assess the generalizability of the current profiles across distinct samples of students (e.g., primary, secondary, and higher education) or individuals (e.g., youth, working adults, aging adults, athletes). Such evidence of generalizability would greatly reinforce the robustness of our conclusions and the possibility to use them to guide the development of person-centered intervention strategies.

It is imperative to keep in mind that these profiles were considered based on three indicators reflecting global (a global factor score assessed from all autonomy, competence, and relatedness items), competence (a specific factor reflecting what is unique to competence satisfaction ratings once the global factor is taken into account), and relatedness (a specific factor reflecting what is unique to relatedness satisfaction ratings once the global factor is taken into account) needs satisfaction. Indeed, the preliminary analyses used to generate the factor scores representing these indicators resulted in the estimation of well-defined global, specific competence, and specific relatedness needs satisfaction factors. However, once the variance in need satisfaction ratings explained by global levels of need satisfaction was taken into account, there remained no meaningful specificity in the indicators of the autonomy factor. This result suggests, as in previous studies (Sánchez-Oliva et al., 2017; Tóth-Király, Bóthe, Orosz, & Rigó, 2018a), that scores on the three items used to assess autonomy need satisfaction provided a clearer indication of students' global need satisfaction than of the specific level of satisfaction of their need for autonomy (revealing no discrepancies or imbalance between

students' reports of their autonomy need satisfaction relative to their global need satisfaction). This finding is also in line with the suggestion that autonomy is a "meta-need" or a "general need" (Assor, 2018) and has a special status relative to the competence and relatedness needs because autonomy is relevant to the regulation and satisfaction of these two needs (Ryan & Deci, 2017).

Given that this study focused on higher education, an educational context in which a student's autonomy is particularly important, this result is not surprising. For instance, university students must learn to assume responsibility for, and take control of, their overall learning experience, ranging from making decisions related to what they choose to learn, to how they will proceed to learn it. This process involves a high level of self-direction, and requires the development of an autonomous and proactive approach in the context of a reduced amount of classroom contact time. Thus, university students must become self-reliant learners and develop an approach to learning allowing them to maintain efforts outside of the classroom context while remaining able to adequately address their own individual needs. Although our results are aligned with those obtained in previous studies showing that need satisfaction is a hierarchically ordered construct best represented by a bifactor model (e.g., Sánchez-Oliva et al., 2017), future investigations relying on bifactor models and using other measures of psychological need satisfaction (e.g., Ntoumanis, 2005; Standage, Duda, & Ntoumanis, 2005) are needed. Such studies would make it possible to assess whether more specificity could remain associated with autonomy need satisfaction within distinct age groups or populations.

Due to its longitudinal nature, the current study was also able to contribute to our understanding of the joint issues of within-person and within-sample stability in need satisfaction profiles in the educational context over the course of a university semester (Kam et al., 2016). In this regard, our results first showed that the profiles identified in this study were essentially unchanged, and thus generalizable, over the course of a university semester (within-sample stability). Indeed, the results from our tests of profile similarity led to the identification of the same number of profiles (configural), presenting the same shape (structural), within-profile variability (dispersion), and size (distributional) across time points.

Second, our results showed that it was possible for within-person changes in profile membership to occur over the course of a semester (within-person stability). More precisely, membership into four (*Globally Dissatisfied*, *Highly Connected*, and *Competence Deficient*, *Globally Dissatisfied and Relatedness Deficient*, *Globally Satisfied*, and *Moderately Satisfied*) of the five need satisfaction profiles remained moderately to highly stable over time (with stability rates ranging from 64.8% and 99.0% over the course of the semester).

In contrast, membership into the *Globally Satisfied and Highly Connected* profile was far more unstable over time (26.1%). Thus, it appears harder to maintain over time a need satisfaction profile presenting such a high level of satisfaction across all needs. It is important to keep in mind that respondents were first-year undergraduate psychology students. These students only recently experienced the transition into university. In itself, this transition involves multiple changes related to classroom composition, teachers (who are now professors), teaching and learning structure, and so on. In addition, this educational transition is itself also associated, for a substantial number of students, with additional important life transitions (De Clercq et al., 2017; Perry et al., 2001). These multiple transformations (e.g., new peer groups) are likely to have a major impact on students' levels of need satisfaction, which could explain why it appeared to be so difficult for students to maintain initially very high levels of need satisfaction across this first university semester as they face, for the first time, the specific expectations of university studies.

In sum, the results obtained in this study revealed that the need satisfaction profiles displayed a high level of within-sample stability, coupled with a moderate to high level of within-person stability for four out of five profiles, over the course of a university semester. It is true that this level of stability could possibly be due, at least in part, to the relatively short time period (one university semester) considered in the present study. Yet, the fact that we were able to observe a considerable level of within-person changes over this time period suggests that changes at the individual level do happen, and can be investigated, over the course of a university semester. Vallerand's (1997) hierarchical representation of human motivation proposes that motivation can be best understood when considered at different levels of analyses (i.e., the global, contextual, and situational levels). When transposed to need satisfaction by Milyavskaya, Philippe, and Koestner (2013), this model thus suggests that it might be useful for future research to similarly disentangle which levels of need satisfaction present the greatest levels of stability or change over shorter and longer time periods. Critically, longitudinal studies are still needed to better identify the mechanisms involved in profile stability and change, and particularly the role of changes occurring in the familial, academic, and personal lives of students.

Perfectionism and Need Satisfaction Profiles

Despite this recognition that changing characteristics of students' life contexts could play an important role in profile membership, this research was more specifically designed to consider the role played by arguably more stable characteristics of students' personality reflected in their levels of socially prescribed and self-oriented perfectionism (Gaudreau & Thompson, 2010). To

the best of our knowledge, no educational research has yet been conducted to ascertain the role of personality-like characteristics in the development of students' need satisfaction profiles in the educational context. Our results revealed that self-oriented perfectionism presented positive associations with students' likelihood of membership into the *Globally Satisfied and Highly Connected* profile relative to all other profiles, and into the *Globally Satisfied* profile relative to the *Globally Dissatisfied, Highly Connected, and Competence Deficient* profile. Thus, this facet of perfectionism appears to be particularly important for students' corresponding to profiles characterized by high levels of global need satisfaction. This result is aligned with previous studies in which self-oriented perfectionism was found to contribute to autonomous motivation (Gillet, Morin, & Reeve, 2017; Harvey et al., 2015; Miquelon et al., 2005) as self-oriented perfectionists tended to rely on self-referenced criteria (Hewitt & Flett, 1991).

In contrast, socially prescribed perfectionism was associated with a decreased likelihood of membership into the *Globally Satisfied and Highly Connected* profile relative to the *Moderately Satisfied, Globally Dissatisfied, Highly Connected, and Competence Deficient*, and *Globally Dissatisfied and Relatedness Deficient* profiles, and into the *Globally Satisfied* profile relative to the *Globally Dissatisfied, Highly Connected, and Competence Deficient* profile. Socially prescribed perfectionism was thus associated with a higher likelihood of membership into profiles with low to moderate levels of global need satisfaction. This finding is consistent with research conducted among samples of students (Stoeber, Feast, & Hayward, 2009) and athletes (Gaudreau & Antl, 2008) showing that socially prescribed perfectionism tends to be connected with controlled motivation. This association is consistent with the idea that students presenting high levels of socially prescribed perfectionism are driven, in great part, by their perceptions of a high level of pressure emerging from their social environment (Gaudreau & Thompson, 2010). Finally, results revealed that sex was not significantly related to the likelihood of profile membership. Contrary to those found by Hollembeak and Amorose (2005), these findings suggest, as demonstrated in past studies (Sánchez-Oliva et al., 2017), that sex did not predict psychological need satisfaction in the educational domain.

More generally, the relations found in the present study were particularly robust. Indeed, these relations not only generalized over the course of a university semester, they were also found to be independent from prior profile membership and to emerge even when controlling for sex. However, it would be interesting to confirm these relations between perfectionism and profile membership when controlling for students' level of education, country of origin, or culture. Moreover, future research should examine whether additional time-changing characteristics might also influence profile membership and

be involved in the prediction of more specific profile transitions over time, such as goal striving, a promotion mindset, achievement motivation, or a possible self.

Outcomes of Students' Need Satisfaction Profiles

Another goal of this research was to better document the affective and behavioral outcomes (i.e., students' interest toward their studies, class attendance, satisfaction, and dropout intentions) of membership into various need satisfaction profiles in the educational context. In this regard, our results revealed a generally well-differentiated pattern of associations between the need satisfaction profiles and various educational outcomes. They also revealed that these associations could be generalized over the course of a university semester. More precisely, students presenting the highest levels of global need satisfaction (*Globally Satisfied*, and *Globally Satisfied and Highly Connected*), regardless of their levels of satisfaction of their more specific needs for relatedness and competence, displayed the greatest levels of interest toward their studies, satisfaction, and attendance, and the lowest levels of dropout intentions. These results thus suggest that the key determinant of positive educational outcomes seems to be the presence of high levels of global need satisfaction, rather than the degree of imbalance in the satisfaction of specific needs over and above that global level.

In demonstrating the positive implications of global need satisfaction, these results are also well aligned with SDT's propositions (Deci & Ryan, 2000), as well as with the results from prior educational studies which also supported these propositions (Jang et al., 2009; Ratelle & Duchesne, 2014). One might have anticipated that the *Globally Satisfied and Highly Connected* profile would yield better outcomes than the *Globally Satisfied* profile as students characterized by a *Globally Satisfied and Highly Connected* profile also tended to experience higher levels of satisfaction of their specific need for relatedness whereas the *Globally Satisfied* profile only presented average levels of relatedness and competence need satisfaction (Sheldon & Niemiec, 2006). However, this pattern of results was not replicated in the present study as the outcomes associated with the *Globally Satisfied* profile could not be differentiated from those of the *Globally Satisfied and Highly Connected* profile. Thus, the combination of high levels of global need satisfaction and specific relatedness need satisfaction does not lead to better outcomes than high levels of global need satisfaction coupled with average levels of specific relatedness need satisfaction. More generally, our findings suggest that the key drivers of the outcomes considered in the present study are really the presence of balanced levels of need satisfaction of at least a moderate magnitude across the psychological needs considered here.

Furthermore, the *Moderately Satisfied* and *Globally Dissatisfied and Relatedness Deficient* profiles did not differ in terms of educational outcomes but were both equally associated with more desirable outcome levels than the *Globally Dissatisfied, Highly Connected, and Competence Deficient* profile. These three profiles presented moderately low levels of global need satisfaction. However, the *Moderately Satisfied* and *Globally Dissatisfied and Relatedness Deficient* profiles also presented similarly high levels of competence need satisfaction. In contrast, the *Globally Dissatisfied, Highly Connected, and Competence Deficient* profile presented high levels of relatedness need satisfaction. These differences observed between these three profiles on the educational outcomes suggests that the satisfaction of the specific need for competence in the educational area may thus help to offset the negative effects of a low level of global need satisfaction, whereas this is not the case for relatedness. These results confirm that specific needs may exhibit differential relations with educational outcomes and are in line with recent bifactor investigations (Sánchez-Oliva et al., 2017; Tóth-Király, Bőthe, Orosz, & Rigó, 2018a) and prior studies showing that competence need satisfaction is a more reliable predictor of educational outcomes than relatedness (Jang et al., 2009; Kashdan et al., 2009). These results are also consistent with Dysvik et al.'s (2013) findings, who showed that competence need satisfaction was positively related to intrinsic motivation only when relatedness need satisfaction was low. More generally, these results highlight the importance of exploring synergistic relations between psychological needs and argue for the added-value of jointly considering the global and specific components of psychological need satisfaction. However, future research is needed to assess whether our results would generalize across linguistic and cultural groups.

Limitations and Directions for Future Research

Limitations have to be considered when interpreting our results. First, this study relied on self-report measures. Such measures can be influenced by various forms of self-report biases (e.g., social desirability). We encourage researchers to build on the present research by incorporating objective achievement and dropout data to their studies, and external ratings (e.g., teacher) of creativity, engagement, and learning strategies as additional outcomes. Second, we used a single item to assess educational satisfaction, which could have made it harder to differentiate the profiles on this outcome variable. When compared to multi-item measures, single-item measures tend to be less reliable to provide a more restricted content coverage. Future research should seek to expand on the previous results via the incorporation of solid measurement scales to their studies. Third, theoretical considerations (e.g., Taylor et al., 2012) guided our treatment of the covariables as predictors

(i.e., perfectionism) or outcomes (i.e., students' interest toward their studies, dropout intentions, class attendance, and educational satisfaction) (Meyer & Morin, 2016). Despite the fact that this approach allowed us to rule out possible effects of predictors on profile transitions, our design and limitations of current analytical possibilities made it impossible to rule out the possibility of reciprocal influences, reverse causality or even spuriousness, as well as the possibility that profile transitions could impact changes in outcome levels. It thus seem important for future longitudinal studies to seek to uncover with greater precision the true directionality of the associations among profiles, outcomes, and predictors, as well as the mechanisms underpinning these associations.

Fourth, as noted above, we relied on a relatively short time interval (one semester), which could have amplified our estimates of profile stability. Yet, our results still revealed that changes did occur over this shorter time interval. Arguably, the stability of the identified need satisfaction profiles is likely to be attenuated, both at the within-sample and within-person levels, if longer time intervals (multiple semesters or a full degree) are considered. In this context, a semester might not be enough to achieve a comprehensive consideration of stability and change in need satisfaction profiles in the educational context.

Fifth, we considered only two types of perfectionism (i.e., socially prescribed and self-oriented) as determinants of students' need satisfaction profiles. It thus appears important for future investigations to consider a broader and more comprehensive set of determinants of need satisfaction profiles among student populations (e.g., teachers' autonomy-supportive behaviors). For instance, future studies might consider students' motives to succeed or to avoid failure, as well as contingent self-esteem, as possible determinants of need satisfaction profiles on the basis of recent research evidence supporting the role of motive dispositions (Lang & Fries, 2006) in the prediction of autonomous and controlled forms of motivation (van der Kaap-Deeder et al., 2016; Michou, Matos, Gargurevich, Gumus, & Herrera, 2016). Sixth, the present results are limited by the fact that they were obtained in a single sample of first-year undergraduate students enrolled in a psychology program in a French university. Future research is needed to assess the generalizability of the present results to student samples with different ages and developmental levels, and from different cultural backgrounds and countries. Seventh, our preliminary analyses revealed a weakly defined S-factor (low factor loadings, low reliability) reflecting students' autonomy need satisfaction once their global levels of need satisfaction were considered. Although, as noted above, this result makes sense given the importance of autonomy for university students, this result made it impossible for us to analyze latent profiles defined using the complete spectrum of global and specific need satisfaction considered to be relevant according to SDT. Clearly, future studies are

needed to examine how the present results generalize, or are complemented, when focusing on more diversified samples of younger students, workers, athletes, and so on.

Finally, SDT has recently demonstrated that need satisfaction and frustration could be two separate psychological experiences that have different antecedents and consequences over time (Chen et al., 2015; Vansteenkiste & Ryan, 2013). Toth-Kiraly, Morin et al. (2018) offered a joint exploration of need satisfaction and frustration in two samples of Hungarian adults, which also supported a bifactor representation. Yet, their results also showed that a single global factor was required to represent participants' global levels of need fulfillment, thus suggesting that these two facets (satisfaction and frustration) might rather form a single underlying continuum rather than really referring to conceptually distinct experiences. Yet, it could be fruitful to also investigate how such bifactor measurement models apply to need satisfaction and frustration in the work domain, and to resort to person-centered analyses to assess need frustration and satisfaction profiles, and their respective associations with work-related antecedents and employee functioning.

Practical Implications

Despite these limitations and pending replication, our results highlight the importance for teachers to be attentive to students experiencing low global levels of need satisfaction in the educational context, especially when those low global levels are coupled with similarly low levels of competence need satisfaction (*Globally Dissatisfied, Highly Connected, and Competence Deficient* profile). Indeed, in this study, these students were found to present a higher level of risk for multiple educational difficulties, including the intention to drop out of their program. Numerous studies have previously documented the benefits of autonomy-supportive teaching behaviors in terms of students' need satisfaction (e.g., Jang et al., 2009; Sheldon & Filak, 2008). Thus, encouraging teachers to display, or to display more, autonomy-supportive behaviors could possibly result in a higher prevalence of the two most desirable profiles among students (*Globally Satisfied and Highly Connected* and *Globally Satisfied*). Obviously, future research would be needed to ascertain the validity of this suggestion. Interestingly, a recent study revealed that students taught in their "preferred ways" (an autonomy-supportive teaching strategy) not only perceived their teacher as being more autonomy-supportive, but also displayed more desirable educational outcomes (Jang, Reeve, & Halusic, 2016).

The present findings showed that self-oriented perfectionism was associated with a greater likelihood of membership into the *Globally Satisfied and Highly Connected* profile relative to all of the other profiles, while an almost

exactly opposite pattern of relations was found for socially prescribed perfectionism. These results thus suggest that decreasing socially prescribed perfectionism and promoting self-oriented perfectionism might help to enhance students' levels of need satisfaction in the educational context, leading in turn to more desirable affective and behavioral outcomes (e.g., students' interest toward their studies, satisfaction). In this regard, Harvey, Moore, and Koestner (2017) showed that parental expectations were positively related to self-oriented perfectionism. Stoeber, Otto, and Dalbert (2009) also found that conscientiousness plays a role in the development of self-oriented perfectionism. In contrast, neuroticism was positively related to socially prescribed perfectionism. Interestingly, certain behavioral and mental health interventions (e.g., behavioral and cognitive-behavioral therapies, metacognitive techniques for setting and achieving goals, cognitive remediation therapies) may prove useful for increasing conscientiousness (Javaras, Williams, & Baskin-Sommers, 2019), and thus lead to higher levels of self-oriented perfectionism.

Attempts to encourage self-oriented perfectionism and decrease socially prescribed perfectionism should be mainly directed at students presenting the lowest levels of global need satisfaction (i.e., *Moderately Satisfied, Globally Dissatisfied and Relatedness Deficient*, and *Globally Dissatisfied, Highly Connected, and Competence Deficient* profiles). It also appears important to enhance, in priority, competence need satisfaction rather than relatedness need satisfaction, at least among university students. Indeed, moderately low levels of global need satisfaction lead to more negative outcomes when relatedness need satisfaction is high (i.e., *Globally Dissatisfied, Highly Connected, and Competence Deficient* profile) than when competence need satisfaction is moderate to high (i.e., *Globally Dissatisfied and Relatedness Deficient* profile).

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