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Predictors and Outcomes of Nursing Students' Engagement Trajectories at the Beginning of their Program

Pierre Cheyroux
QualiPsy EE 1901, Université de Tours, Tours, France
Alexandre J.S. Morin
Substantive-Methodological Synergy Research Laboratory, Concordia University, Montreal, Québec, Canada
Philippe Colombat
QualiPsy EE 1901, Université de Tours, Tours, France
Nicolas Gillet
QualiPsy EE 1901, Université de Tours, Tours, France
Institut Universitaire de France (IUF)

Corresponding author:
Nicolas Gillet,
Université de Tours,
UFR Arts et Sciences Humaines,
Département de psychologie,
3 rue des Tanneurs, 37041 Tours Cedex 1, France
Phone : (+33) 2-47-36-65-54
E-mail: nicolas.gillet@univ-tours.fr

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Abstract

This study seeks to achieve a dynamic understanding of nursing students' engagement trajectories, of the predictive role of their levels of harmonious passion, obsessive passion, exposure to challenge and hindrance demands, and perceptions of institutional support in relation to their engagement trajectories. We also consider the implications of these trajectories for a variety of outcomes related to students' attitudes (i.e., dropout intentions and program satisfaction), psychological health (i.e., negative affect and life satisfaction), and behaviors (i.e., performance and absenteeism). A sample of 2515 first-year nursing students were surveyed five times, with intervals of one month, over a four-month period during the first semester of their program. Our results revealed four profiles of students presenting High and Stable, Moderate and Decreasing, Low and Decreasing, and Moderate and Stable engagement trajectories. Harmonious and obsessive passion, challenge and hindrance demands, and institutional support were associated with these trajectories in a way that mainly supported our expectations. Trajectories characterized by lower levels of engagement were associated with higher levels of negative affect and absenteeism, and with lower levels of performance, program satisfaction, and life satisfaction. Conversely, trajectories characterized by higher levels of engagement were associated with lower levels of dropout intentions and higher levels of performance.

Keywords: Engagement; trajectories; latent curve modeling (LCM); challenge and hindrance demands; passion; dropout intentions; well-being; performance.

Defined three decades ago as the harnessing of one's self to one's role as an employee or as a student (Kahn, 1990), engagement has since been recognized as a key driver of performance, well-being, and positive functioning (e.g., Meyer & Schneider, 2021; Tao et al., 2022). In light of these recognized benefits, recent reports of low levels of engagement in the workforce (Harter, 2020; Harter et al., 2002) and among students (Jones et al., 2021; Wise et al., 2022) are troubling. For instance, in 2020, only 20% of employees were actively engaged at work, resulting in costs due to a loss of productivity corresponding to $483 to $605 billion for the U.S. economy and $8.1 trillion for the global economy (nearly 10% of the global GDP) (Gallup, 2021). Similarly, only 46% of students reported feeling engaged at school in 2021 (Idaho State Department of Education, 2022). These statistics highlight the need for a better understanding of the evolution of engagement as it first starts to emerge among students in the context of professional training programs leading directly into the workforce, and particularly of the main drivers of engagement falling under the control of schools and teachers. In this study, we consider these questions as they unfold in the context of the first semester of nursing studies, based on the critical role played by engagement as a driver of patient care quality, retention, and well-being within the nursing occupation (McKenna & Jeske, 2021; Parr et al., 2021).

By harnessing their identity and resources to support their occupational and academic roles (Kahn, 1990), engaged employees (Rich et al., 2010) and students (Owen et al., 2018) invest themselves physically, cognitively, and emotionally into these roles. Engagement has always been conceptualized as a global construct jointly defined by students' levels of physical, cognitive, and emotional investment into their professional of educational role (Dierendonck et al., 2021; Gillet et al., 2018, 2019a, 2020c; Houle et al., 2022; Tóth-Király et al., 2021). Importantly, students' global levels of engagement tend to share much stronger associations with a variety of predictors and outcomes (e.g., performance, dropout intentions, satisfaction, absenteeism, negative affect) relative to their specific levels of physical, cognitive, or emotional engagement (Gillet et al., 2020c; Neuber et al., 2022; Shuck et al., 2017). These conclusions appear to hold across settings (e.g., education, work, sport), cultures, and operationalization of engagement (either as a single score, as higher-order engagement scores, or as separate engagement dimensions). These results underscore the relevance of primarily considering nurses' global levels of engagement in their studies as the core dimension of engagement.

Like many other psychological constructs reflecting how one interacts with the environment (Hofmans et al., 2021), students' engagement is usually conceptualized as a dynamic phenomenon that fluctuates over time and shares time-structured associations with other constructs (Olivier et al., 2022; Sonnentag et al., 2021). However, only a handful of studies have adopted a methodological approach able to account for this dynamic nature (e.g., Upadyaya & Salmela-Aro, 2013; Zhen et al., 2020). Moreover, little is currently known about the factors that contribute to influence the development of engagement as it evolves over time, and about the psychological implications of different engagement trajectories. This is preoccupying when we consider that a primary purpose of engagement research should be to provide actionable information to help students develop, maintain, and even improve their engagement over time. Rather, a significant part of engagement research seems to have stagnated on studying the intricacies of how engagement is experienced at any given point in time, without giving much thought to its dynamic evolution. Indeed, the bulk of research on engagement has so far relied on cross-sectional designs, or on limited longitudinal designs (including only two measurement points; Gillet et al., 2020b; Snijders et al., 2022), making it impossible to entirely capture the dynamic nature of engagement trajectories (Fletcher et al., 2018; Zhu et al., 2019). To inform this issue, which is a core objective of the present study, more extensive longitudinal designs (i.e., including three or more time points and thus allowing for the estimation of the shape taken by engagement trajectories over time) are necessary (e.g., Ployhart & Vandenberg, 2010).

The present study addresses this important limitation via the adoption of a longitudinal design and the reliance on growth mixture analyses (Morin & Litalien, 2019), which are specifically designed to help us identify the different types (or profiles) of engagement trajectories most commonly observed among nursing students. More precisely, we relied on a sample of nursing students surveyed five times, one month apart, over a total period of four months in their first semester of studies (O'Neal et al., 2019). The reliance on one-month intervals is aligned with the range of time intervals usually considered appropriate in research focusing on first-year students' school attitudes (e.g., Prud'homme et al., 2022), and the reliance on five time points was deemed sufficient to allow us to establish the shape of students' trajectories over this initial training period (Grimm et al., 2016).

The present research first seeks to achieve a significant contribution to engagement research and theory by helping us to better understand how students' engagement levels evolve at the start of their training, and more importantly how this evolution differs across distinct subpopulations of students. In doing so, we also hope to help inform the development of interventions specifically targeted at nursing students presenting more problematic trajectories while supporting those displaying more desirable ones. For instance, identifying unstable engagement trajectories would be consistent with a high level of malleability and environmental reactivity which would, in turn, support the use of ongoing intervention strategies.

Second, this study also seeks to improve our understanding of the mechanisms involved in the evolution of nursing students' engagement trajectories by considering their time-structured associations with a series of predictors anchored in the theoretical perspective of the job demands-resources model (Bakker et al., 2014; Demerouti et al., 2001; i.e., harmonious and obsessive passion [HP and OP], challenge and hindrance demands, and institutional support). In doing so, we hope to contribute to the literature on the job demands-resources model (Demerouti et al., 2001), given that knowledge is still lacking regarding how longitudinal changes in job demands and resources can be linked to changes in engagement. Furthermore, in this literature, there is also a need to better understand the role of personal resources (e.g., HP) in explaining changes in engagement (Xanthopoulou et al., 2007, 2009). From a practical standpoint, we also seek to achieve a better understanding of what drives nursing students' engagement trajectories and, in turn, to identify factors upon which interventions could capitalize to better support engagement among all nursing students in a way that matches their unique profile of engagement. Indeed, this knowledge is an important prerequisite to the development of effective interventions designed to nurture, support, and enhance nurses' engagement in their studies and after, and in doing so, to promote their optimal functioning. For instance, understanding the time-structured role of a theoretically relevant set of key drivers for engagement should help maximize the success of interventions by highlighting how interventions might be structured over time in order to maximize their benefits in terms of engagement.

Third, to better understand the drivers and implications of these trajectories, we also consider their time-structured associations with a series of outcomes related to students' attitudes (i.e., dropout intentions and program satisfaction), psychological health (i.e., negative affect and life satisfaction), and behaviors (i.e., performance and absenteeism). Achieving a clearer understanding of how these different trajectories can support or thwart their well-being and ability to function efficiently (e.g., Jedwab et al., 2023; Parr et al., 2021) should help us determine which profiles of students are most important to target for intervention.

Lastly, our focus on a sample of first-year nursing students is also critical from a practical perspective. At the start of their professional training, it is often hard for nursing students to understand how the theoretical knowledge acquired in their education can translate into their upcoming professional practice. This type of theory-practice gap has long been recognized as a major problem in the development of nursing science and the training of nursing students (Bouchlaghem & Mansouri, 2018), and could be partially explained by a lack of student engagement in their professional training. Moreover, nursing students often face stressful situations from the first moments of their professional education (Gürdil Yilmaz et al., 2022), including the intense level of stress typically associated with their first clinical experiences (Li et al., 2020) and resulting from their lack of professional knowledge and skills, perceptions of time pressure, and various coping difficulties (Uysal & Çalışkan, 2022). Furthermore, given the many challenges nurses face when carrying out their professional tasks, the smooth running of healthcare organizations is partly linked to the ability of nursing students to learn and quickly transfer the knowledge acquired during their training (Arabi & Garza, 2023). Unfortunately, although healthcare organizations consider training to be essential to the professional development of nurses and invest a great deal of money in this area, the problems associated with training transfer are real. Indeed, nursing students have difficulties transferring their learning to their subsequent professional practice, and these difficulties may also be linked to a lack of engagement (Salamon et al., 2023). Finally and more generally, the success of learning experiences, and the resulting engagement toward nursing (e.g., Pfaff et al., 2014), is known to positively impact nurses' quality of care, well-being, and retention over the course of their career (McKenna & Jeske, 2021; Parr et al., 2021).

The Theoretical Perspective of the Job Demands-Resources Model

The present study is anchored in the theoretical perspective of the job demands-resources model

(Bakker et al., 2014; Demerouti et al., 2001). The job demands-resources model defines demands as characteristics of the work or educational context requiring individuals to expand psychological and/or physical efforts in an ongoing manner and thus taking a toll on exposed individuals (Bakker et al., 2014; Calderwood & Gabriel, 2017). More recently, LePine et al. (2005) noted that not all types of demands are harmful, and proposed to expand the job demands-resources model to differentiate between hindrance (i.e., demands that obstruct personal growth and goal attainment) and challenge (i.e., demands that provide opportunities for growth, achievement, and learning) demands. Although both types of demands push individuals to expand some of their physical and psychological resources, challenge demands can compensate for this loss by providing these individuals with opportunities to gain new resources (Cavanaugh et al., 2000; Crawford et al., 2010). The job demands-resources model (Bakker et al., 2014; Demerouti et al., 2001) also positions resources as personal or contextual characteristics that help individual achieve their goals, contribute to limit the toll taken by job demands, and stimulate growth and development. Although key resources are personal in nature (Xanthopoulou et al., 2007), contextual resources are particularly important to help individuals face job demands without having to expand all their personal resources (Nielsen et al., 2017).

A Longitudinal Perspective on Engagement

When seeking to understand the longitudinal dynamics of engagement, a first source of evidence comes from rank-order stability coefficients. Alessandri et al. (2018) noted that job engagement was moderately stable over a period of one year (r = .63) among a sample of white-collar employees, whereas Jiang et al. (2022) reported similar rank-order stability coefficients (r = .66 over one year to r = .58 over 18 months) in a younger sample of seventh graders. These results are consistent with the presence of a moderate level of fluctuations over time. A second source of evidence comes from the examination of longitudinal trajectories of engagement. Some studies have found job engagement to slightly increase as a function of age among mixed samples of employees (James et al., 2011; Kim & Kang, 2017) and undergraduate students (Covas & Veiga, 2021), whereas others found decreasing trajectories among samples of secondary students followed over the course of their studies (Goñi et al., 2018) or of employees followed for a period of five days (Zuo et al., 2021). Others also reported evidence of stability in engagement levels during the first five weeks following the implementation of an organizational change (van den Heuvel et al., 2020). Despite these generic tendencies, research clearly highlights the presence of substantial inter-individual heterogeneity in the shape of these trajectories (e.g., Upadyaya & Salmela-Aro, 2013; van den Heuvel et al., 2020).

Although these previous results may seem hard to reconcile, the presence of inter-individual variability suggests that all possible shapes (e.g., high, low, increasing) might be occurring among different segments of the population (Morin & Litalien, 2019). To better describe the nature of this heterogeneity, three studies have relied on longitudinal person-centered analyses, focusing on the three years preceding retirement among older workers (55 to 62 years; de Wind et al., 2017), young adults followed from 17 to 21 years old (Upadyaya & Salmela-Aro, 2013), and elementary school students followed for a period of one year (Zhen et al., 2020). Despite their differences, these studies converged on highly similar results, and identified four distinct types of engagement trajectories: (1) high and stable (de Wind et al., 2017; Zhen et al., 2020) or high and increasing (Upadyaya & Salmela-Aro, 2013; Zhen et al., 2020); (2) low and stable (de Wind et al., 2017; Upadyaya & Salmela-Aro, 2013) or low and decreasing (Zhen et al., 2020); (3) initially high but decreasing (de Wind et al., 2017; Upadyaya & Salmela-Aro, 2013) or initially moderate but decreasing (Zhen et al., 2020); and (4) initially low but increasing (de Wind et al., 2017; Upadyaya & Salmela-Aro, 2013).

When considering the bulk of prior research, it is important to acknowledge that it comes from studies conducted among very specific samples of employees (i.e., white-collar: Alessandri et al., 2018; entrepreneurs: Zuo et al., 2021, Study 1; exposed to organizational changes: van den Heuvel et al., 2020; pre-retired: de Wind et al., 2017) and students (i.e., seventh graders: Jiang et al., 2022; young adults: Upadyaya & Salmela-Aro, 2013; elementary students: Zhen et al., 2020). This specificity supports the idea that results, especially those related to the four common types of engagement trajectories identified in previous person-centered analyses, seem to generalize across various types of samples and age groups. However, this specificity also highlights the need for replication among samples falling in between the purely educational and the purely organizational areas, such as the nursing students currently enrolled in professional training programs. Based on previous results, we expect that:

Hypothesis 1 (H1). At least four distinct profiles of engagement trajectories will be identified in this

study from the subset of those identified in previous research. These trajectories will display: (1) high initial levels with stable or increasing trajectories, (2) low initial levels with stable or decreasing trajectories; (3) moderate to high initial levels with decreasing trajectories, and (4) low initial levels with increasing trajectories.

Determinants of Engagement Trajectories

Engagement is conceptualized as an indicator of positive psychological functioning emerging from the experience of a congruence between individuals' own goals and values and those of their environment (Kahn, 1990; Rich et al., 2010). As a result, engagement trajectories should demonstrate reactivity to fluctuations in the characteristics of the professional training context (Gillet et al., 2015a; Sonnentag, 2017). For instance, and consistent with self-determination theory (Ryan & Deci, 2017), students exposed to high levels of autonomy (Flunger et al., 2022), to personally meaningful tasks (Kwok & Fang, 2021), to opportunities to experience feelings of competence (Olivier et al., 2020), and to supportive environments (Jin & Wang, 2019) demonstrate higher levels of engagement, whereas those exposed to less desirable and supportive school environments display lower levels of engagement (Adigun et al., 2022). However, to accurately grasp the dynamic nature of the time-structured associations between characteristics of the professional training context and engagement trajectories in a way that can help guide the development of dynamic interventions, longitudinal methods are required. Unfortunately, very little research has so far examined these questions dynamically. Among the few exceptions, Grazia (2022) uncovered time-structured positive associations between school climate and student engagement. Relatedly, Gheorghe et al. (2022) demonstrated the benefits of positive interdependence for engagement, whereas negative interdependence and social independence had a negative effect on engagement.

The present study seeks to add to our understanding of the time-structured associations between contextual predictors and engagement trajectories by considering the role of educational demands (i.e., challenge and hindrance demands), personal resources (i.e., HP and OP), and educational resources (i.e., institutional support). Our decision to focus on these dimensions as predictors of engagement trajectories is anchored in this theoretical perspective of the job demands-resources model (Bakker et al., 2014; Demerouti et al., 2001), which explicitly acknowledges their role as drivers of engagement. Indeed, numerous studies in line with this theoretical perspective have shown that challenge and hindrance demands, as well as HP, OP, and social support, have significant effects on engagement (e.g., Birkeland & Buch, 2015; Crawford et al., 2010; Zhou et al., 2019). We first highlight the theoretical importance of considering different types of demands, before addressing the complementary role of educational and personal resources.

Challenge and Hindrance Demands. From the theoretical perspective of the job demands-resources model (Demerouti et al., 2001), students exposed to high levels of demands need to devote time, efforts, and energy to properly handle these demands, in a way that rapidly sap their ability to maintain a persistently high level of engagement in their studies (Hobfoll, 2002). Moreover, students exposed to higher levels of demands also tend to experience feelings of restlessness outside of their educational setting, making it hard for them to properly withdraw from their academic tasks during off-school time (Kinnunen et al., 2017). In failing to properly stop thinking about their studies, these students often create more work for themselves (Sonnentag & Fritz, 2015), thus increasing their risk of exhaustion and making it harder for them to remain engaged in their studies (Bakker et al., 2014). Supporting these theoretical assertions, research has shown that demands are associated with multiple detrimental outcomes across multiple life areas, including lower levels of engagement in one's education (Rost et al., 2021; Salmela-Aro et al., 2022).

With regard to the distinction between challenge and hindrance demands, students exposed to challenges are likely to anticipate a positive association between the efforts expended coping with these demands and their likelihood of meeting these demands, thus leading them to become more engaged in their studies. Conversely, students exposed to hindrances are more likely to anticipate that efforts expended coping with these demands will likely end up sapping valuable resources that could otherwise be used for dealing with other types of demands, thus decreasing their levels of engagement (LePine et al., 2005). In other words, challenges are likely to stimulate students, whereas hindrances are likely to discourage them (Gillet et al., 2019; LePine et al., 2005). Meta-analyses have supported these theoretical assertions, showing that challenges tended to be associated with far more positive outcomes, including engagement, than hindrance demands (Crawford et al., 2010; Goering et al., 2017), leading us to expect

that:

Hypothesis 2 (H2). Higher initial levels of challenge demands and lower initial levels of hindrance demands will be associated with: (a) a higher likelihood of membership into trajectories characterized by higher initial levels of engagement, (b) higher within-profile initial levels of engagement, and (c) within-profile increases in engagement.

Hypothesis 3 (H3). Increases over time in levels of challenge demands and decreases over time in levels of hindrance demands will be associated with: (a) a higher likelihood of membership into trajectories characterized by higher increases over time in engagement levels, and (b) within-profile increases in engagement.

Institutional Support as a Key Educational Resource. Within the wide range of possible contextual characteristics likely to act as resources for students, institutional support arguably occupies the center of the stage (Salazar et al., 2022; San & Guo, 2022), as it specifically seeks to help students face contextual demands while retaining their personal resources. More precisely, institutional support reflects the extent to which students' feel that their institution cares about their well-being and values their contribution (Eisenberger et al., 1986). Institutional support is known to contribute to the development of trust, autonomy, positive self-perceptions, and positive social interactions (Eisenberger & Stinglhamber, 2011; Kurtessis et al., 2017). From this perspective, it can be expected to foster the satisfaction of students' basic psychological needs (Gillet et al., 2019b, 2020a), positioned as critical drivers of intrinsic motivation, engagement, well-being, and performance according to self-determination theory (Deci et al., 2017; Ryan & Deci, 2017), a theoretical framework often used to explain the mechanisms whereby job demands and resources influence behavior (Gillet et al., 2015a). As a result, institutional support should motivate students to invest even more energy into their professional training (Gillet et al., 2019c, 2020b), thus supporting their engagement (Cheon et al., 2019). These assertions have been supported by previous studies (Jin & Wang, 2019; Zhou et al., 2019), leading us to expect that:

Hypothesis 4 (H4). Initial perceptions of institutional support will be associated with: (a) a higher likelihood of membership into trajectories characterized by higher initial levels of engagement, (b) higher within-profile initial levels of engagement and (c) within-profile increases in engagement.

Hypothesis 5 (H5). Increases over time in perceptions of institutional support will be associated with: (a) a higher likelihood of membership into trajectories characterized by higher increases over time in engagement levels, and (b) within-profile increases in engagement.

Passion as a Key Double-Edge Personal Resource. Personal resources are known to represent critical drivers of performance, engagement, and well-being (Xanthopoulou et al., 2007, 2009, 2013). However, expanding personal resources is a double-edge sword as once there are gone, they need to be replenished, and failure to do so is likely to lead to exhaustion (Sonnentag & Fritz, 2015). Passion directly captures this duality of personal resources. More precisely, the dualistic model of passion (Vallerand, 2015; Vallerand & Houlfort, 2019) differentiates between HP (a strong psychological investment in an activity [study] that is freely chosen by the individual) and OP (a strong psychological investment in an activity [study] that originates from internal or external contingencies associated with the activity). For students with high levels of HP, education can co-exist in a state of harmony with other facets of their existence, allowing them to establish adaptive boundaries between their education and their personal life (Vallerand, 2015). As a result, HP helps students build, accumulate, and recover school-related resources resulting from the enjoyment (i.e., engagement; Vallerand & Houlfort, 2019) they derive from studying (e.g., health, positive mood, knowledge and skills; Hobfoll, 2002). As these school-related resources accumulate, they are likely to become available to support students in meeting their school demands (Bakker et al., 2014).

In contrast, students with high levels of OP tend to engage in their studies with a rigid persistence, feeling an uncontrollable urge to study, making it harder to establish clear boundaries between their studies and other facets of their existence, thereby increasing the likelihood that their education will interfere with other areas of their life, in turn resulting in detrimental outcomes (Vallerand, 2015). For instance, high levels of OP for one's education was associated with higher levels of procrastination and psychological distress (Peixoto et al., 2021). Similarly, Verner-Filion and Vallerand (2016) have shown that OP was positively related to negative affect among undergraduate students. However, obsessively passionate students also have a profound inclination toward their studies, are fully invested in their studies, and display high energy at school, thus resulting in higher levels of engagement. Because their

passion is tied to various contingencies, they are unlikely to study purely because they enjoy it, leading them to experience lower engagement than their HP colleagues (Vallerand & Houlfort, 2019). Research has generally supported these expectations, showing that HP tends to be associated with higher levels of engagement, satisfaction, and well-being, whereas OP tends to be associated with more detrimental outcomes (negative affect, burnout) (Bélanger & Ratelle, 2021; Berg et al., 2020; Birkeland & Buch, 2015; Gillet et al., 2022; Huyghebaert-Zouaghi et al., 2022a; Schellenberg & Bailis, 2015; Trépanier et al., 2014). However, prior studies have also shown that OP also shares positive associations with engagement (Birkeland & Buch, 2015; Ho & Astakhova, 2018), although these associations are stronger for HP than for OP (Tóth-Király et al., 2021), leading us to expect that:

Hypothesis 6 (H6). Initial levels of HP and OP will be associated with: (a) a higher likelihood of membership into trajectories characterized by higher initial levels of engagement, (b) higher within-profile initial levels of engagement and (c) within-profile increases in engagement.

Hypothesis 7 (H7). Increases over time in HP and OP will be associated with: (a) a higher likelihood of membership into trajectories characterized by higher increases over time in engagement levels, and (b) within-profile increases in engagement.

Hypothesis 8 (H8). The associations described in H6 and H7 will be stronger for HP than for OP.

Outcomes of the Engagement Trajectories

Many theoretical arguments have been offered to account for the positioning of engagement as a core driver of positive functioning (Kahn, 1990; Rich et al., 2010; Tao et al., 2022). For instance, highly engaged students have been proposed to be more physically active, cognitively vigilant, and emotionally connected to the pursuit of their education (e.g., Burns et al., 2019). As a result, their engagement should help them to better cope with the emotional demands of their program (Kahn, 1990). Likewise, highly engaged students are typically described as experiencing more positive perceptions of their role as learners, as viewing their studies as being more agreeable and stimulating, and as deriving more pleasure from the accomplishment of their educational tasks, which should all lead to more adaptive outcomes (Suárez et al., 2019). In contrast, students characterized by lower levels of engagement are generally expected to withhold their energy, leading them to adopt a detached and passive approach to their studies (Kahn, 1990). In addition, their lack of interest and volition in relation to work also leads them to limit their interactions with their teachers and peers, to miss some schooldays, and to refrain from engaging in several tasks (Gillet et al., 2017b), thereby limiting their satisfaction and increasing their dropout intentions.

The present study expands upon prior longitudinal research by considering a broad range of outcomes pertaining to nursing students' attitudes (i.e., dropout intentions and program satisfaction), psychological health (i.e., negative affect and life satisfaction), and behaviors (i.e., performance and absenteeism), all frequently studied in research based on the job demands-resources model (Demerouti et al., 2001). These dimensions are also known to be highly relevant to their educational success and ability to engage in satisfactory career trajectories. Thus, negative affect has often been related to reduced levels of performance, due in part to its negative impact on students' behavioral, motivational, physical, and/or cognitive functioning (Chin et al., 2017; Goodhew & Edwards, 2022). Likewise, dropout intentions have long been recognized as a direct, and critically important, precursor of a wide variety of undesirable educational outcomes (e.g., actual dropout: Sarrazin et al., 2002; reduced performance: Haque, 2021). Absenteeism is also an important outcome to consider given its negative associations with learning, achievement, executive functioning, and social skills (e.g., Gottfried & Ansari, 2022). In contrast, program and life satisfaction are typically considered as positive drivers of performance (Lepp et al., 2014; Ramsey & Lorenz, 2016) and citizenship behaviors (Whitman et al., 2010), which themselves help maintain higher levels of satisfaction (Spector & Fox, 2002). Higher levels of satisfaction are also related to various indicators of career success (Proyer et al., 2012). Finally, students' learning and performance in professional training programs may facilitate school-to-work transition and subsequent performance improvement in daily job tasks (Blume et al., 2010; Okolie, 2022). Importantly, all of these outcomes were selected due to their known dynamic nature (Hale et al., 2016; Willroth et al., 2021), making them naturally suited to the investigation of their time-structured associations with engagement trajectories.

Although research has seldom investigated these outcomes as dynamic outcomes of engagement trajectories, the bulk of research on engagement has reported positive associations between engagement and levels of performance, school satisfaction, and life satisfaction, as well as negative associations

between engagement and levels of negative affect, dropout intentions, and absenteeism (e.g., Gillet et al., 2015b; Lovelace et al., 2017; Vîrgă et al., 2022). Thus, we propose that:

Hypothesis 9 (H9). Students' time-specific levels of engagement will be associated with matched time-specific levels of performance, program satisfaction, and life satisfaction, and inversely associated with their levels of negative affect, dropout intentions, and absenteeism.

Method

Sample and Procedure

This study relies on a sample of 2515 first-year nursing students (M_{age} = 22.52; SD_{age} = 7.62; 89.4% female) recruited in France. This dataset has never been used in previous publication. Very few participants (5.9%) were repeating their first year as nursing students. Roughly half of the participants were single (48.4%), while the other half were in a couple (51.6%). Most of the participants had no children (83.7%), 40.6% benefitted from a scholarship, and 52.1% received financial help from their family. Finally, 19.1% of the participants had an outside job to financially support their education.

Participation was voluntary and all participants enrolled in this nursing program were invited to complete a self-report questionnaire at the beginning of the school year (Time 1, T1: n = 1697), and then one (Time 2, T2: n = 898), two (Time 3, T3: n = 606), three (Time 4, T4: n = 292), and four (Time 5, T5: n = 314) months later. At each data collection point, members of the research team explained the purpose of the study to all students who, after providing informed consent, proceeded to complete a 15-minute web-based questionnaire. Participants were ensured that their responses would be kept confidential and would not impact their education. They were also asked to provide a personal identification code to allow researchers to match their responses over time.

Measures

Most measures were already validated in French (i.e., engagement, passion, institutional support, negative affect, satisfaction, performance, and absenteeism). Measures not already validated in French (i.e., demands and dropout intentions) were adapted to French using a translation back-translation procedure realized by independent bilingual experts. Discrepancies were resolved by consensus.

Engagement. Student's engagement in their studies was assessed using the French version (Houle et al., 2022) of the Job Engagement Scale (JES; Rich et al., 2010). The JES captures the three dimensions of engagement described in Kahn's (1990) theoretical model: (a) *physical engagement* (three items; e.g., "I try my hardest to perform well during this program"; α_{t1} = .854; α_{t2} = .869; α_{t3} = .868; α_{t4} = .875; and α_{t5} = .899); (b) *cognitive engagement* (six items, e.g., "During this program, I focus a great deal of attention on my work"; α_{t1} = .733; α_{t2} = .773; α_{t3} = .773; α_{t4} = .789; and α_{t5} = .823); and (c) *emotional engagement* (six items, e.g., "I am enthusiastic about my program"; α_{t1} = .863; α_{t2} = .857; α_{t3} = .865; α_{t4} = .851; and α_{t5} = .874). All items were rated on a 1 (*strongly disagree*) to 5 (*strongly agree*) response scale and can be used together to assess participants' global levels of engagement (α_{t1} = .913; α_{t2} = .912; α_{t3} = .913; α_{t4} = .908; and α_{t5} = .928), which is the approach taken in this study (Gillet et al., 2018, 2019a, 2020c).

Demands (predictor). Six items from French et al. (2019) were used to assess perceptions of challenge (three items; e.g., "How often does your work demand a high level of skill or expertise?"; α_{t1} = .663; α_{t2} = .681; α_{t3} = .648; α_{t4} = .670; and α_{t5} = .681) and hindrance (three items; e.g., "How often do you have a lot of interruptions?"; α_{t1} = .660; α_{t2} = .614; α_{t3} = .643; α_{t4} = .707; and α_{t5} = .592) demands. All items were rated on a five-point response scale ranging from "Never" to "Always".

Passion (predictor). We assessed HP (three items; e.g., "This program is in harmony with the other things that are part of me"; α_{t1} = .792; α_{t2} = .780; α_{t3} = .823; α_{t4} = .841; and α_{t5} = .867) and OP (three items; e.g., "I have almost an obsessive feeling for this program"; α_{t1} = .749; α_{t2} = .695; α_{t3} = .716; α_{t4} = .687; and α_{t5} = .700) using a scale developed in French by Philippe et al. (2017). Items were rated on a seven-point scale (Strongly disagree to Strongly agree).

Institutional support (predictor). Institutional support was assessed using a four-item measure developed in French by Caesens et al. (2014; e.g. "My institute really cares about my well-being"; α_{t1} = .673; α_{t2} = .742; α_{t3} = .788; α_{t4} = .819; and α_{t5} = .794). All items were rated on a seven-point response scale ranging from "Strongly Disagree" to "Strongly Agree".

Negative affect (outcome). Negative affect was assessed using five items (Thompson, 2007; French version by Gillet et al., 2017a; e.g., "upset"; α_{t1} = .752; α_{t2} = .749; α_{t3} = .789; α_{t4} = .792; and α_{t5} = .813). Responses were provided using a five-point scale ranging from 1 (not at all) to 5 (extremely).

Dropout intentions (outcome). Dropout intentions were assessed using a three-item (e.g., "I often

think about dropping out of my current program"; α_{t1} = .925; α_{t2} = .920; α_{t3} = .939; α_{t4} = .945; and α_{t5} = .950) measure developed by Bardach et al. (2020). Responses were provided using a six-point scale ranging from 1 (Strongly disagree) to 6 (Strongly agree).

Satisfaction (outcome). Satisfaction toward the program (i.e., "Are you satisfied with this program?") and life satisfaction (i.e., "Are you satisfied with your life?") were each assessed using a one-item measure (Shimazu et al., 2015; French version by Fouquereau et al., 2019). Responses were provided on a scale ranging from 1 (Dissatisfied) to 4 (Satisfied).

Performance (outcome). Performance during the last month was assessed using one item (i.e., "How would you rate your overall program performance during the last month") from the World Health Organization Health and Work Performance Questionnaire (Kessler et al., 2003; French version by Huyghebaert et al., 2018). Responses were provided using a scale ranging from 0 (Worst performance) to 10 (Best performance).

Absenteeism (outcome). Absenteeism was assessed using a single-item measure (Kessler et al., 2003; French version by Sandrin et al., 2020) asking participants to indicate how many entire days they missed during the last month because of problems related to their physical or mental health.

Analyses

Preliminary Measurement Models

Our main analyses were conducted using factor scores (to achieve a partial correction for unreliability) obtained as part of preliminary measurement models (in which their measurement invariance was established to ensure comparability over time; Millsap, 2011). For all measures, these factor scores were estimated in standardized units (M = 0, SD = 1) at T1 and as deviations from T1 expressed in SD units at the following time points to simplify interpretations. These engagement factor scores were taken from a bifactor measurement model, allowing us to obtain a global estimate of students' global levels of engagement across dimensions while controlling for subscale specificity (e.g., Gillet et al., 2020; Houle et al., 2022). More precisely, a bifactor model directly tests whether a global construct, reflected through a global engagement factor, exists as a unitary dimension underlying the answers to all items, while also accounting for the fact that specificities may remain associated with the specific facets of engagement (physical, cognitive, and emotional) defined by the part of the items that is unexplained by the global engagement factor. Thus, bifactor models assume that there exists a global engagement construct underlying answers to all items included in the JES, which is consistent with Rich et al.'s (2010) conception of engagement. This measurement approach is also consistent with current recommendations regarding the optimal operationalization of engagement (e.g., Gillet et al., 2018, 2019a, 2020c; Houle et al., 2022). However, as our objective specifically focuses on global levels of engagement (rather than on the unique role of its various components), only scores on this global engagement factor will be used. For predictors and outcomes, the factor scores used in our main analyses were obtained following a two-step procedure advocated by Morin et al. (2011; also see Sandrin et al., 2022). First, longitudinal correlated factors models were estimated and used to test the measurement invariance of participants' ratings on the multi-item predictor and outcome measures. Second, longitudinally invariant scores on these factors were used to estimate latent curve models reflecting participants' individual trajectories (Bollen & Curran, 2006).

For all predictors and outcomes, we contrasted linear, curvilinear, and nonlinear (latent basis) models to select the optimal representation of these trajectories (Grimm et al., 2016). Linear trajectories are represented by a random intercept factor reflecting the initial level of the trajectories (the occasion-specific measures are linked to this factor by loadings of 1) and a random linear slope factor reflecting the rate of change in these trajectories over time (the occasion-specific measures are linked to this factor by loadings reflecting the passage of time in monthly units in this study). In this study, the loadings on the slope factor were fixed to a value of 0 (T1: Initial level), 1 (T2: One month after T1), 2 (T3: Two months after T1), 3 (T4: Three months after T1), and 4 (T5: Four months after T1). Quadratic models are specified as the linear models, but with the addition of a quadratic growth factor (the occasion-specific measures are linked to this factor by squaring the time codes used to define the linear slope factor) reflecting the curvature of these trajectories. Finally, latent basis models are similar to linear models, but rely on a free estimation of the time codes (i.e., the loadings on the slope factors) associated with T2, T3 and T4, while fixing those associated with T1 and T5 to a respective value of 0 and 1. As a result, these models do not impose any shape on the growth trajectories, and result in a slope factor representing the total amount of change occurring over the course of the study, while the freely

estimated loadings describe the proportion of this change occurring at each time point. A linear model was retained for HP and OP, negative affect, performance, and absenteeism. A latent basis model was retained for challenge and hindrance demands, institutional support, and dropout intentions. A quadratic model (intercept, linear slope, and quadratic slope) was retained for students' satisfaction toward the program and life satisfaction. Details on all preliminary analyses (factor solutions, longitudinal invariance, intraclass correlations, first-order correlations, reliability, and latent curve analyses) are described in the online supplements.

Growth Mixture Models (GMM)

All analyses were conducted in Mplus 8.8 (Muthén & Muthén, 2022) using the maximum likelihood robust (MLR) estimator. Missing responses were handled using Full Information Maximum Likelihood (FIML) procedures (e.g., Enders, 2010), allowing us to estimate all models without relying on the problematic listwise deletion of participants who did not complete all time points. More precisely, a total of 2515 students were used in the analyses, and provided 3807 occasion-specific ratings. Due to the way the online questionnaire was programmed, there were no missing responses for participants who completed each measurement occasion.

Linear[1] GMM including one to eight global engagement trajectories were estimated, using 12000 random start values, 2000 iterations, 2000 second stage optimizations, and 200 final optimizations (Hipp & Bauer, 2006). In linear GMM, repeated measures are summarized via random intercepts and random slope factors, defined as in the preliminary latent curve analyses. In GMM, all parameters (intercepts and slope means, intercept and slope variance-covariance, and time-specific residuals) should ideally be freely estimated across profiles (Diallo et al., 2016; Morin et al., 2011). However, this recommendation comes with the recognition that this free estimation of all parameters often results in improper or nonconverging solutions due to overparameterization, which supports the need to rely on simpler models (Diallo et al., 2016; Morin & Litalien, 2019). When this happens, as in the present study, equality constraints should be progressively implemented across profiles (Diallo et al., 2016). Following recommendations from Diallo et al. (2016), we relied on a parameterization in which the means of the growth factors and the time-specific residuals of the trajectories were freely estimated across profiles, while the variance-covariance of the growth factors were constrained to equality across profiles (corresponding to the Mplus' default parameterization) and the time-specific residuals were constrained to equality (homoscedasticity) over time (but free to vary across profiles), corresponding to the traditional multilevel operationalization of growth models (Li & Hser, 2011).

The optimal number of profiles was determined by considering the theoretical conformity, heuristic meaning, and statistical adequacy of each solution (Morin & Litalien, 2019; Muthén, 2003). This selection was also guided by statistical indices, including the Akaïke Information Criterion (AIC) and its consistent version (CAIC), the Bayesian Information Criterion (BIC) and its sample-size adjusted version (ABIC), and two types of likelihood ratio tests (LRT): (1) the Lo, Mendell, and Rubin's (2001) adjusted LRT (aLMR), and (2) the Bootstrap LRT (BLRT). When statistically significant, the aLMR or BLRT support the addition of a profile relative to the previous solution, whereas lower values on the AIC, CAIC, BIC, and ABIC suggest a superior model fit. According to statistical simulation studies, the CAIC, BIC, ABIC, and BLRT are effective guides of the optimal number of profiles, whereas the AIC and aLMR are not and are only reported to ensure complete disclosure (e.g., Diallo et al., 2016, 2017; Nylund et al., 2007; Tein et al., 2013). However, these indicators are all impacted by sample size (Marsh et al., 2009), and thus often fail to converge on a specific solution. When this happens, information criteria should be presented graphically ("elbow plots") and plateaus can help identify the optimal number of profiles (Morin et al., 2011). We also report the entropy as an indicator of classification accuracy (0-no accuracy to 1-perfect accuracy).

Predictors and Outcomes

The intercept and slope factor scores representing participants' trajectories on the predictors and outcomes were integrated to the final solution. Models including predictors were contrasted based on a strategy suggested by Diallo et al. (2017). We first estimated associations between participants' engagement trajectories and demographic predictors [age (coded in years); sex (0: males; 1: females);

[1] To verify the possible nonlinearity of engagement trajectories, we also considered alternative solutions relying on a quadratic (curvilinear) or latent basis (non-linear) parameterization. However, none of these alternative solutions resulted in profiles displaying any of evidence of curvilinearity or nonlinearity.

having repeated a grade (0: no; 1: yes); conjugal situation (0: single; 1: in couple); number of kids at home; having a bursary (0: no; 1: yes); financial help from the family (0: no; 1: yes); and external work (0: no; 1: yes)] to verify the relevance of retaining these variables as controls in our main predictive models. This was done by contrasting a series of alternative models. In the first (null) model, the effects of the demographic predictors on the likelihood of profile membership, as well as on within-profile variations in the intercept and slope of the engagement trajectories were constrained to be 0. In subsequent models, we freely estimated the effects of these demographic predictors on the likelihood of profile membership, on within-profile variations in the intercepts of the engagement trajectories, and on within-profile variations in the slopes of the engagement trajectories. For the last two specifications, when significant effects were found, we also tested whether these effects differed across profiles. In a second step, a similar sequence was estimated to assess the predictive role of the intercepts of the predictor trajectories (initial levels of the predictors), starting from the final model retained in the previous step. After estimating a null model, we tested the effects of the intercepts of the predictor trajectories on profile membership, on within-profile variations in the intercepts of the engagement trajectories, and on within-profile variations in the slopes of the engagement trajectories. For the last two specifications, when significant effects were found, we tested whether these effects differed across profiles. Finally, in a third step, we assessed the predictive role of the slopes of the predictor trajectories (changes over time in predictor levels), starting from the final model retained in the previous step. More precisely, we verified whether these slopes predicted profile membership and within-profile variations in the slope of the engagement trajectories in a way that was identical, or differed, across profiles. These models were contrasted using information criteria (CAIC, BIC, and ABIC, where a lower value indicates a better model fit; Diallo et al., 2017; Morin et al., 2016).

Finally, outcome levels (i.e., participants' scores on the intercept, linear slope, and quadratic slopes of their outcome trajectories) were contrasted across profiles using then Mplus' Auxiliary (DCON) function (Asparouhov & Muthén, 2014; Lanza et al., 2013). This approach makes it possible to compare the profiles, defined in a probabilistic manner, in relation to a variety of outcomes.

Results

Selection of the Optimal Number of Profiles

The fit of the alternative unconditional GMM solutions is reported in the top section of Table 1. All indicators kept on suggesting adding profiles without converging on an optimal solution, although the CAIC, BIC, and ABIC kept on decreasing until the five-profile solution, before increasing again, and then kept on decreasing until eight profiles. The elbow plot associated with these indicators is reported in Figure S1, near the end of the online supplements, and reveal a plateauing in the decrease in the value of these information criteria between the two- and five- profile solutions. These solutions were more thoroughly examined. Moving from two, to three, and then to four profiles resulted in meaningful additions, corresponding to Profiles 1 and 4 represented in Figure 1. However, adding a fifth profile resulted in the arbitrary division of Profile 4 (from Figure 1) into two smaller profiles following a virtually identical trajectory, whereas adding a sixth profile resulted in the addition of an empty profile. For this reason, the four-profile solution was retained for interpretation. This solution is graphically presented in Figure 1, and detailed parameter estimates are reported in Table 2. This solution has a high level of classification accuracy, ranging from 76.5% to 91.2% across profiles (see Table S9 in the online supplements), consistent with its high entropy (.809).

Profile 1 characterizes 6.45% of the students presenting initially high levels of engagement and following stable trajectories (*High and Stable*). Profile 2 characterizes a higher proportion of students (69.21%) presenting initially average levels of engagement and following decreasing trajectories over time (*Moderate and Decreasing*). Profile 3 characterizes 16.37% of the students presenting initially low levels of engagement and following decreasing trajectories (*Low and Decreasing*). Finally, Profile 4 characterizes 7.97% of the students presenting initially low levels of engagement and following stable trajectories (*Low and Stable*). These results support H1. Interestingly, the time-specific residuals associated with this solution indicate that stable trajectories (characterized by a lack of increase or decrease over time) also tend to display lower levels of time-specific fluctuations over time, suggesting that stable trajectories are stable at the trait and state levels. In contrast, among decreasing trajectories, time-specific fluctuations tend to be more pronounced when engagement levels are low rather than moderate, suggesting that low and decreasing engagement trajectories also tend to fluctuate more widely over time relative to higher or more stable trajectories.

Predictors

The fit of the models including the demographic predictors are reported in the second section of Table 2. These results indicate that the effect of these variables is limited to the prediction of within-profile variations in initial levels of engagement (the intercept of the engagement trajectories), and that this effect does not differ across profiles (i.e., Model D1 resulted in an increase in the value of the information criteria relative to the null model and was thus rejected, whereas these values decreased in Model D2 which was retained, before increasing again in Models D3 and D4). However, an examination of the parameter estimates associated with the retained model reveals that only two demographic predictors (age and having repeated a grade) were associated with these intercepts, leading us to retain only these two demographic predictors in further analyses. These results indicate that age is associated with higher initial levels of engagement within each of the profiles (b = .126; s.e. = .011; $p \leq .01$; β = .186), whereas having repeated a grade is associated with lower within-profile initial levels of engagement (b = -.084; s.e. = .041; $p \leq .05$; β = -.029).

The fit of models including the predictors (in addition to the two retained controls) are reported in the bottom of Table 1. These results first show that initial levels of the predictors (intercepts of the predictors trajectories) were associated with participants' likelihood of profile membership (Model P1 resulted in a decrease in the value of the information criteria relative to the null model), as well as with within-profile variations in the intercepts and slopes of the engagement trajectories in a way that differed across profiles (Models P2-P5 all resulted in a decrease in the value of the information criteria relative to Model P1). Starting from Model P5, we then considered the possible role of changes over time in predictors levels (slopes of the predictor trajectories). These changes in predictor levels were not associated with participants' likelihood of profile membership (Model P6 resulted in an increase in the value of the information criteria relative to Model P5) but were associated with within-profile variations in the slope of their engagement trajectories in a way that differed across profiles (Models P7-P8 resulted in a decrease in the value of the information criteria relative to Model P5). The results from Model P8, reported in Table 3, were retained for interpretation.

Concerning associations between initial levels on the predictors and participants' likelihood of membership into the various profiles of engagement trajectories, we first found that initial levels of challenge demands predicted a higher probability of membership into the *High and Stable* profile relative to the three other profiles. Second, we found that initial levels of hindrance demands predicted a higher probability of membership into the *Low and Decreasing* profile relative to the *Moderate and Decreasing* and *Low and Stable* profiles. These results partially support H2. Third, and failing to support H4, we found no evidence of association between initial levels of institutional support and profile membership. Fourth, we found that initial levels of HP predicted a higher probability of membership into the *Moderate and Decreasing* profile relative to all other profiles, and into the *High and Stable* profile relative to the *Low and Decreasing* and *Low and Stable* ones. Fifth, we found that initial levels of OP predicted a lower probability of membership into the *Low and Decreasing* profile relative to the *Moderate and Decreasing* and *Low and Stable* ones. These results partially support H6.

Concerning the associations between initial levels on the predictors and within-profile variations in the initial levels and increases over time in engagement levels, we first found that initial levels of challenge demands predicted higher initial levels of engagement in the *High and Stable*, *Moderate and Decreasing*, and *Low and Decreasing* profiles, although this effect was smaller in the *High and Stable* profile than in the other two profiles. Moreover, initial levels of challenge demands also predicted more pronounced decreases in engagement levels over time in the *Moderate and Decreasing* and *Low and Decreasing* profiles, while increases in challenge demands predicted increases in engagement levels in the *High and Stable*, *Moderate and Decreasing*, and *Low and Decreasing* profiles. Second, initial levels of hindrance demands also predicted lower initial levels of engagement in the *Low and Decreasing* profile, as well as decreases over time in engagement levels in the *High and Stable* profile. Increases in hindrance demands also predicted decreases in engagement levels in the *High and Stable* and *Low and Stable* profiles (although the former effect is stronger than the latter), as well as increases in engagement levels in the *Moderate and Decreasing* and *Low and Decreasing* profiles. These results partially support H2 and H3. Third, initial levels of institutional support predicted increases in engagement levels over time in the *Low and Stable* profile. Increases in institutional support also predicted increases in engagement levels in the *Low and Stable* profile. These results partially support H4 and H5. Fourth, initial levels of HP also predicted higher initial levels of engagement in the *Moderate and Decreasing*

profile, while increases in HP predicted increases in engagement levels in the *Moderate and Decreasing* profile. Fifth, initial levels of OP also predicted higher initial levels of engagement in the *High and Stable*, *Moderate and Decreasing*, and *Low and Decreasing* profiles, although this effect was smaller in the *High and Stable* profile than in the other two profiles. Moreover, increases in OP predicted increases in engagement levels in the *Moderate and Decreasing*, *Low and Decreasing*, and *Low and Stable* profiles, although this effect is smaller in the *Low and Stable* profile. These results partially support H6, H7, and H8.

Outcomes

The results related to the associations between the outcome trajectories and our profiles are reported in Table 4 and illustrated in Figure 2. These results reveal profiles clearly differentiated from one another on the outcomes in a way that differs across outcomes, and generally support H9.

First, initial levels and increases over time in negative affect are higher in the *Low and Decreasing* profile relative to the other profiles. Second, initial levels of dropout intentions are the highest in the *Low and Decreasing* profile, followed by the *Low and Stable* profile, then by the *Moderate and Decreasing* profile, and finally by the *High and Stable* profile. Furthermore, whereas dropout intentions increase over time in the *High and Stable* and *Moderate and Decreasing* profiles, they decrease over time in the *Low and Decreasing* and *Low and Stable* profiles. As illustrated in Figure 2, the increasing and decreasing tendencies observed in the various profiles are not strong enough to counteract the differences observed initially, leaving the *Low and Decreasing* profile to experience the highest dropout intentions over time.

Third, initial levels of performance are the highest in the *High and Stable* profile, followed by the *Moderate and Decreasing* profile, then by the *Low and Stable* profile, and finally by the *Low and Decreasing* profile. Whereas performance increases over time in the *High and Stable* profile, it decreases in the three other profiles (with a larger decrease in the *Low and Decreasing* profile). Fourth, initial levels of absenteeism are lower in the *High and Stable* profile relative to the other profiles, while increases in levels of absenteeism are more pronounced in the *Moderate and Decreasing*, *Low and Decreasing*, and *Low and Stable* profiles relative to the *High and Stable* one.

Fifth, initial levels of program satisfaction are the highest in the *High and Stable* profile, followed by the *Moderate and Decreasing* profile, and finally by the *Low and Decreasing* and *Low and Stable* profiles, which do not differ from one another. Furthermore, decreases in levels of program satisfaction are more pronounced in the *Moderate and Decreasing* and *Low and Decreasing* profiles relative to the other two profiles. Trajectories of program satisfaction are also characterized by a slight curvilinear trend (mainly reflecting a reduction in the rate of change after T3). This trend is more pronounced in the *Moderate and Decreasing* and *Low and Decreasing* profiles relative to the other two profiles. Finally, initial levels of life satisfaction are higher in the *High and Stable* and *Moderate and Decreasing* profiles than in the *Low and Decreasing* and *Low and Stable* profiles. Furthermore, decreases in levels of life satisfaction are more pronounced in the *Moderate and Decreasing* and *Low and Decreasing* profiles relative to the *High and Stable* one. Life satisfaction trajectories are also characterized by a slight curvilinear trend (mainly reflecting an acceleration in the rate of change after T3), which is more pronounced in the *High and Stable* profile than in the other profiles.

Discussion

Despite the well-documented benefits of engagement for students and employees (Rich et al., 2010; Tao et al., 2022), most prior studies have ignored the dynamic nature of engagement (Hofmans et al., 2021; Sonnentag et al., 2021), with only a few exceptions (van den Heuvel et al., 2020; Zuo et al., 2021). The current research sought to address this limitation by focusing on the diverse nature of engagement trajectories observed among a sample of nursing students followed over time during the first semester of their professional training program. To better understand what drives these emerging engagement trajectories, we also considered the role of students' perceptions of institutional support, their levels of HP and OP, and their perceptions of exposure to challenge and hindrance demands as dynamic predictors of these trajectories. Finally, to obtain a comprehensive perspective of the implications of these trajectories, we examine their associations with students' levels of negative affect, dropout intentions, absenteeism, performance, program satisfaction, and life satisfaction.

Longitudinal Trajectories of Engagement

Previous longitudinal investigations of engagement have yielded inconsistent results, revealing stable (van den Heuvel et al., 2020), increasing (James et al., 2011; Kim & Kang, 2017), or decreasing

(Zuo et al., 2021) trajectories over time. Although this variation in results suggests possible specificities associated with the nature of the participants included in these studies, it also suggests that there might be substantial inter-individual heterogeneity in the shape of these trajectories. Indeed, previous person-centered studies of engagement trajectories, specially designed to represent this heterogeneity have generally converged on a set of four most prototypical types of trajectories (de Wind et al., 2017; Upadyaya & Salmela-Aro, 2013; Zhen et al., 2020): (1) high trajectories that are either stable or increasing; (2) low trajectories that are either stable or decreasing; (3) initially high or moderate trajectories that decrease over time; and (4) initially low but increasing trajectories. In the present study, we specifically focused on identifying the diverse nature of the engagement trajectories present in a sample of first-year nursing students and found that four main profiles best summarized that diversity: (1) High and Stable; (2) Moderate and Decreasing; (3) Low and Decreasing; and (4) Low and Stable. Particularly noteworthy was the observation that these four profiles generally corresponded to most of those identified previously among older employees (de Wind et al., 2017), young adults (Upadyaya & Salmela-Aro, 2013), and elementary students (Zhen et al., 2020), although no increasing trajectory was identified in the present study, and two low trajectories were found rather than one. These discrepancies are likely related to our focus on first-year nursing students, for whom engagement trajectories will still be evolving and consolidating based on more in-depth discovery of the nature of their chosen profession (e.g., Boswell et al., 2009; Solinger et al., 2013). Indeed, upon entry into a new professional training program, students are more likely to remain cautious in terms of their identification with the nursing occupation, and those with initially low or moderate levels are unlikely to change their mind after a single semester of study (e.g., Wanberg, 2012). It would be interesting for future research to investigate whether and how these trajectories keep on evolving over the rest of the professional training program and across nurses' transition into the workforce.

Considering these results in more details, two of the profiles displayed stable trajectories of engagement over the course of the study (High and Stable, Low and Stable). This observation is consistent with previous studies highlighting that engagement tends to remain moderately to highly stable over time (Alessandri et al., 2018; Gillet et al., 2019a). However, this stability also suggests that these students might be waiting to learn more about their chosen occupation before changing their mind about how well it matches their initially high or low expectations (Boswell et al., 2009; Solinger et al., 2013). In the meantime, those with high levels of engagement should be able to capitalize on this personal resource to provide them with the energy and motivation needed to cope with school-related difficulties, challenges, and transformations (Dierendonck et al., 2021). For these students, the gain spiral highlighted in the conservation of resources theory (Hobfoll, 2002) suggests that maintaining these high levels of engagement are likely to facilitate access to other resources related to the achievement of academic goals and well-being (Burns et al., 2019). In contrast, for students with initially low levels of engagement, the opposite is likely to occur as their lack of energy and motivation for their program is likely to allow them to progressively fall more and more behind their colleagues as time goes on (Wise et al., 2022). Once again, these hypotheses would need to be more thoroughly investigated in longer term investigations.

In contrast, the remaining two profiles displayed decreasing engagement trajectories, thus reinforcing the idea that engagement might display some reactivity to the school context (Adigun et al., 2022), and suggesting the presence of increasing levels of dissatisfaction toward that program or disappointment with the newly discovered nature of their chosen profession. In this regard, it was particularly concerning to note that 85.58% of our participants displayed one of those decreasing engagement trajectories. This observation suggests that most of them display an increasingly passive role in their education, present an increasing risk of experiencing failures or setbacks, and feel that their program is unable to properly fulfil their needs for autonomy, competence, and relatedness (Huyghebaert-Zouaghi et al., 2022b). For instance, these students might come to develop negative relationships with their teachers or colleagues, fail to understand the purpose of their training, or be unable to set realistic personal goals for themselves (Ryan & Deci, 2017). They might also be exposed to instructors who fail to provide them with purposeful, transparent, engaging, and challenging learning opportunities (Sandrin et al., 2022) that share a connection with the true nature of the nursing occupation (Gholami et al., 2021). Alternatively, discovering what the occupation truly entails might also be the reason for this increasing disappointment (e.g., Boswell et al., 2009; Solinger et al., 2013). Beyond these hypothetical considerations, studies will be needed to examine the reasons underlying this high

prevalence of decreasing engagement trajectories among new nursing students. Fortunately, the theoretical predictors considered in this study provide some information in this regard.

Predictors of Engagement Trajectories

Consistent with prior results showing positive relations between challenge demands and engagement (Goering et al., 2017), as well as with H2 and H3, our results revealed that initial levels of challenge demands predicted a higher probability of membership into the *High and Stable* profile, as well as higher initial levels of engagement in the *High and Stable*, *Moderate and Decreasing*, and *Low and Decreasing* profiles. Similarly, increases in challenge demands predicted increases in engagement in the *High and Stable*, *Moderate and Decreasing*, and *Low and Decreasing* profiles. In contrast, initial levels of hindrance demands predicted a higher probability of membership into the *Low and Decreasin*g profile, as well as lower initial levels of engagement in the *Low and Decreasing* profile and decreases in engagement levels in the *High and Stable* profile. Lastly, increases in hindrance demands predicted decreases in engagement levels in the *High and Stable* and *Low and Stable* profiles, an effect that was stronger in the *High and Stable* profile. These results are consistent with past research showing negative associations between hindrance demands and engagement (Crawford et al., 2010), with the theoretical perspective of the job demands-resources model (Bakker et al., 2014; Demerouti et al., 2001), and with H2 and H3.

Moreover, although initial levels of institutional support and increases over time in these levels shared no associations with profile membership, they predicted increases in engagement levels over time in the *Low and Stable* profile, thus partially supporting H4 and H5. These observations are consistent with previous reports of positive associations between students' perceptions of institutional support and their levels of school engagement (Jin & Wang, 2019; Zhou et al., 2019). They also confirm, as postulated in the job demands-resources model (Demerouti et al., 2001), that institutional support is a key educational resource helping to nurture and support engagement. Furthermore, our results showed that initial levels of HP predicted a higher probability of membership into the *High and Stable* profile relative to the *Low and Decreasing* and *Low and Stable* ones. These results support H6, the assumptions of the dualistic model of passion (Vallerand, 2015), and findings from prior variable-centered research demonstrating the positive effects of HP on a variety of outcomes, including engagement (Vallerand & Houlfort, 2019). They also confirm, as already demonstrated in previous research anchored in the job demands-resources model (Xanthopoulou et al., 2007, 2009, 2013), that HP is a personal resource associated with higher levels of engagement. In relation to OP, our results were also consistent with H6 and H7. More precisely, we found that initial levels of OP seemed to help students stay away from the *Low and Decreasing* profile, and helped increase initial levels of engagement in the *High and Stable*, *Moderate and Decreasing*, and *Low and Decreasing* profiles. Consistent with H8, this last effect was also smaller in the *High and Stable* profile. Similarly, increases in OP did not predict increases in engagement levels in the *High and Stable* profile, but did so in the *Moderate and Decreasing*, *Low and Decreasing*, and *Low and Stable* profiles.

Focusing specifically on the effects of passion, conceptualized as a double-edged personal resource, our results are consistent with the idea that OP students tend to display a strong inclination toward their studies, to be fully invested in their studies, and to display high levels of energy at school (Ho & Astakhova, 2018). Thus, although OP has often been found to be linked to a variety of detrimental consequences (Vallerand & Houlfort, 2019), our results also support the idea that it also carries some benefits (Amiot et al., 2006; Lafrenière et al., 2009; Schellenberg et al., 2021) at least when directed at an objectively important activity (i.e., education). Indeed, despite the obsessive nature of their passion, these students may still come to experience positive emotions when engaging in their studies, particularly following the experience of success (Lafrenière et al., 2009). Yet, and also because of this obsessive nature, these benefits are not as pronounced as those of HP, possibly as a result of the more imbalanced nature of OP which tends to take a greater toll on students (Vallerand, 2015), making it harder to replenish their other personal resources. These results do not suggest that OP is necessarily desirable. Rather, they simply suggest that it might be preferable for students to be passionate for their studies, no matter the dominant type of passion, than to experience a complete lack of passion (Philippe et al., 2009). More generally, as highlighted in the dualistic model of passion (Vallerand, 2015), passion is a personal resource associated with higher levels of engagement (Xanthopoulou et al., 2009). However, more studies are needed to examine whether and how the effects of passion observed in this study generalize to other positive and detrimental outcomes (e.g., motivation, boredom, bullying), if

only to verify that the current benefits in terms of engagement do not generate even more troublesome outcomes (e.g., burnout) among OP students.

However, some of our results were inconsistent with our expectations. First, initial levels of challenge demands unexpectedly predicted more pronounced decreases in engagement levels over time in the *Moderate and Decreasing* and *Low and Decreasing* profiles. These results can be explained based on the person-environment fit perspective (Etzel & Nagy, 2016). Indeed, students initially displaying low to moderate levels of engagement and who are immediately exposed to high levels of challenge demands may feel overwhelmed by these demands and come to question their ability to efficiently cope with them – despite their challenging nature. Indeed, like all demands, coping with challenges still require substantial effort (Calderwood & Gabriel, 2017), which might simply prove to be too much for students already facing the challenging period of entry into a new program for which their level of engagement is not that high. However, in the same two profiles, our results also showed that increases over time in hindrance demands predicted increases in engagement levels. This second set of results suggest that hindrance demands may sometimes have positive effects (Jimmieson et al., 2017). A tentative explanation for this result is that students lacking high levels of engagement may decide to focus on manageable aspects of their program rather than try to address all obstacles that hinder their progress (Gonzalez-Mulé et al., 2021). Moreover, they may come to see these hindrances (e.g., being interrupted in their work) as a normative part of their chosen profession, and thus rely on their presence to externally attribute some of their difficulties (Lambert & Miller, 2010). Over time, these external attributions might help them to set more realistic goals for themselves, thereby increasing their levels of engagement (Levine et al., 2017). Clearly, additional research will be needed to verify these interpretations.

Second, the effects of institutional support were limited to students displaying *Low and Stable* levels of engagement, suggesting that institutional support might be a particularly useful lever to nurture engagement among less engaged students. Conversely, institutional support had no effect for students who were already engaged in their program, nor did it help curb the decline observed in the other two profiles, suggesting that its benefits are limited and should mainly be the focus of targeted interventions strategies. It would be interesting for future research to examine whether and how these effects generalize to other valuable sources of support, such as peers, family, and teachers.

Third, higher levels of HP seemed particularly beneficial with students presenting moderate levels of engagement, being associated with higher initial levels of engagement among these students, but also helping them to curb their otherwise decreasing engagement trajectories. Although these within-profile benefits of HP are consistent with the expectations of the dualistic model of passion (Vallerand, 2015; Vallerand & Houlfort, 2019) and the positive effects of personal resources (e.g., HP) on work engagement (Xanthopoulou et al., 2009, the fact that higher initial levels of HP increase the chances of adopting a moderate, relative to high, trajectory of engagement while being beneficial once these moderate trajectories have been adopted, suggest the fact presence of a ceiling, or curvilinear (inverted U-shape), effect to the benefits of HP. Interestingly, this study is not the first to allude to possible ceiling effects, as Astakhova (2015) also reported an inverted U-shape associations between HP and organizational citizenship behaviors. The conversation of resources theory (Hobfoll, 2002) could potentially explain part of these results by suggesting that one of the reasons for which students may decide to curb their engagement is to protect their personal resources, in order to better expand them in other spheres of their life (Huyghebaert-Zouaghi et al., 2022a). Interestingly, this desire to achieve a balance between different life spheres is also a defining characteristic of HP (Vallerand, 2015; Vallerand & Houlfort, 2019). Yet, it remains encouraging to note that HP still helps students stay away from profiles characterized by low levels of engagement, while increasing their likelihood of adopting either a high or a moderate trajectory.

Outcomes of Engagement Trajectories

Supporting H9, the *Low and Decreasing* profile (immediately followed by the *Low and Stable* profile for most of these outcomes) displayed the highest initial levels and increases over time in negative affect and dropout intentions, as well as the lowest initial levels and most pronounced decreases in performance. In contrast, the *High and Stable* profile (immediately followed by the *Low and Stable* profile for most of these outcomes) displayed the lowest initial levels and increases in dropout intentions and absenteeism, the highest initial levels of performance, program satisfaction, and life satisfaction, and the steepest increases in performance over time. Furthermore, it was interesting to

note that decreases in program satisfaction and life satisfaction were generally more pronounced in both profiles characterized by decreasing trajectories of engagement (*Moderate and Decreasing* and *Low and Decreasing*). These results are entirely consistent with accumulating evidence highlighting the multiple benefits of engagement (e.g., Gillet et al., 2019a; Vîrgă et al., 2022), as well as the idea that these benefits are still likely to differ across outcomes (e.g., Gillet et al., 2019a; Lovelace et al., 2017), thus reinforcing the need to expand the present results to a wider range of outcome variables. Moreover, these results also indicate that decreases over time in engagement seem to be particularly detrimental to students' program and life satisfaction, regardless of their initial level of engagement, thus replicating previous evidence to this effect (Lewis et al., 2011). From a practical standpoint, this suggest that it might be important to limit the decreases in students' engagement to maintain satisfactory levels of satisfaction.

Finally, trajectories of program and life satisfaction were characterized by a slight curvilinear trend mainly reflecting a reduction (program satisfaction) or an acceleration (life satisfaction) in the rate of change after T3. These results suggest that the experiences of first-year nursing students after two months of training appear to be particularly important. Thus, institutional managers and teachers would do well to be particularly vigilant about what happens in their program at this specific point in time, which seems to represent a pivotal moment for students. Indeed, after two months, students have taken their bearings and are now more familiar with the functioning of their institution. Their initial enthusiasm, or lack thereof, linked to the discovery of a new environment is starting to fade, allowing them to change their initial views. This moment thus seems to represent a potentially key time point to start exposing students to need new experiences (e.g., professional internships, work placements) designed to maintain or reinforce their engagement, motivation, and satisfaction (Sandrin et al., 2022).

Theoretical and Practical Implications

Our findings provide a better understanding of how students' engagement evolves during the first few months of their training, while showing that these trajectories differ from one student to another. Moreover, many of our results met our theoretical expectations, anchored in the job demands-resources model (Bakker et al., 2014; Crawford et al., 2010; Demerouti et al., 2001; LePine et al., 2005) and in the dualistic model of passion (Vallerand, 2015) in demonstrating the benefits of challenge demands, educational resources (institutional support), and personal resources (HP and, to a lesser extent, OP), and the risks posed by hindrance demands in relation to students' engagement trajectories. Beyond the empirical demonstration that these theoretical approaches are relevant to understanding changes in engagement over time, these results are important because they enable us to identify levers of action aimed at increasing students' engagement, or at least limiting the decrease in engagement observed among many students. Indeed, it should be emphasized that a very large majority of students (over 80%) show engagement trajectories characterized by a decline in engagement over the course of their training. Finally, our results clearly demonstrated the importance of students' engagement trajectories for a variety of critically important outcomes related to their attitudes (i.e., dropout intentions and program satisfaction), psychological health (i.e., negative affect and life satisfaction), and behaviors (i.e., performance and absenteeism).

From a practical standpoint, our results highlight the importance for institutions and teachers to focus on students displaying persistently low or decreasing engagement trajectories, as these students seem exposed to higher risks of impaired functioning (e.g., dropout intentions, negative affect). In this regard, our findings suggested that interventions seeking to improve institutional support may be useful to increase engagement among students' displaying persistently low trajectories of engagement. To nurture such perceptions of institutional support, it may be helpful to promote a supportive culture to help teachers break down the walls between themselves and students. In such environments, teachers and students come to share power and to be more attuned to one another identity and culture, resulting in higher opportunities for the co-creation of learning experiences and knowledge (e.g., participatory action research, project-based learning). Promoting procedural justice is also a meaningful way to increase institutional support (Eisenberger & Stinglhamber, 2011).

Moreover, HP could also be promoted by stating clear segmentation norms and encouraging balanced and healthier lifestyles, and by creating well-being-oriented school environments (Kreiner, 2006). HP could also be increased at the individual level through coaching or counseling (Van Gordon et al., 2017). More generally, it might be useful to encourage more efficient work recovery processes to protect students' school well-being and to facilitate positive spillover between their school and personal roles (Huyghebaert-Zouaghi

et al., 2022a). Indeed, research has shown that efficient work recovery can be developed and trained. For instance, participants involved in a recovery training program (e.g., time management, self-reflection) displayed better recovery experiences and higher levels of sleep quality after the training, in comparison to those not involved in this training (Hahn et al., 2011). Similar results have been reported for mindfulness-based interventions (Hülsheger et al., 2015).

Finally, because self-regulatory resource depletion is an important reason for the negative effects of hindrance demands (Puranik et al., 2021), interventions that specifically seek to manage these demands or that are focused more generally on reducing self-regulatory demands in the school environment (e.g., redesigning classrooms to reduce distracting background noises, implementing less stringent school discipline rules), could help reduce the negative effects of hindrance demands.

Limitations and Future Directions

The current study offers the first examination of the nature, predictors, and outcomes of school engagement trajectories over a five-month period among a sample of first-year nursing students. However, it also has limitations. First, we solely relied on self-report measures, which come with an increased risk of social desirability and self-report biases. Future investigations should include more objective indicators of students' behaviors (e.g., dropout, absenteeism), as well as multiple informants' ratings (e.g., peers, teachers). Second, this study involved a sample of French students followed over a five-month period at the start of their nursing education. Other investigations will be needed to confirm the generalizability of our findings across different cultures and countries, as well as the extent to which our conclusions generalize to other predictors and outcomes. Although we considered predictors (i.e., passion, demands, and institutional support) of students' engagement trajectories, it would be interesting for upcoming investigations to incorporate other individual (e.g., psychological capital, motivation) or organizational (e.g., perceived teacher support, perceived justice) predictors of these trajectories, as well as a more diverse set of outcomes (e.g., objective performance, physical health, actual dropout).

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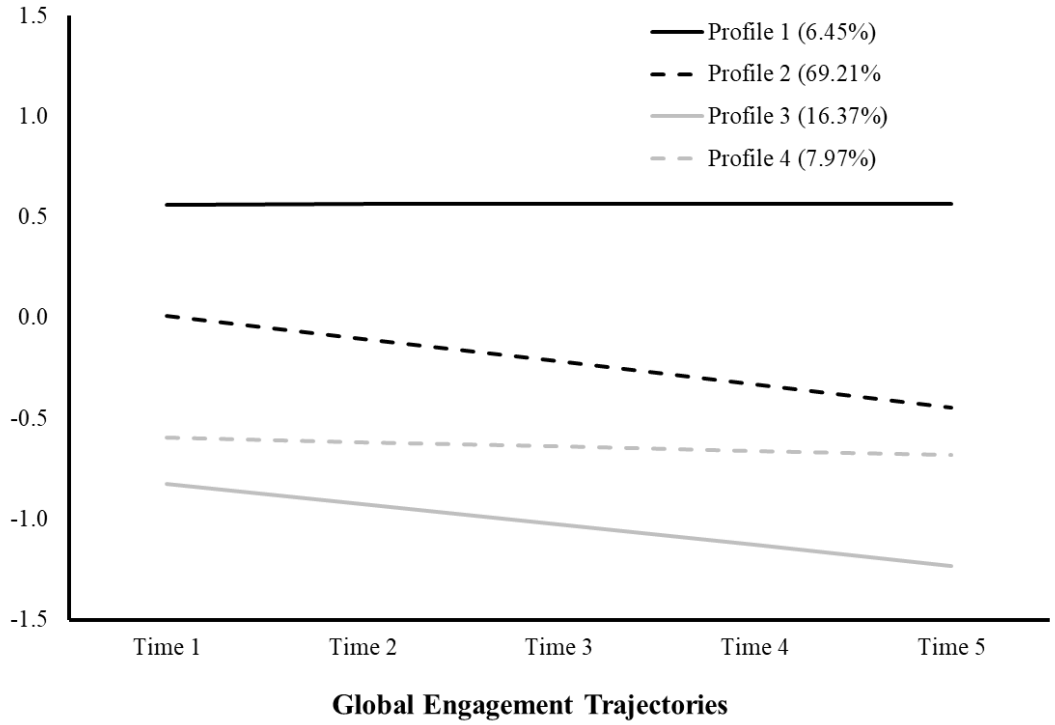

Figure 1. Final Four-Profile Solution: Engagement Trajectories
Note. Profile indicators are factor scores with a mean of 0 and a standard deviation of 1; Profile 1: High and Stable; Profile 2: Moderate and Decreasing; Profile 3: Low and Decreasing; and Profile 4: Low and Stable.

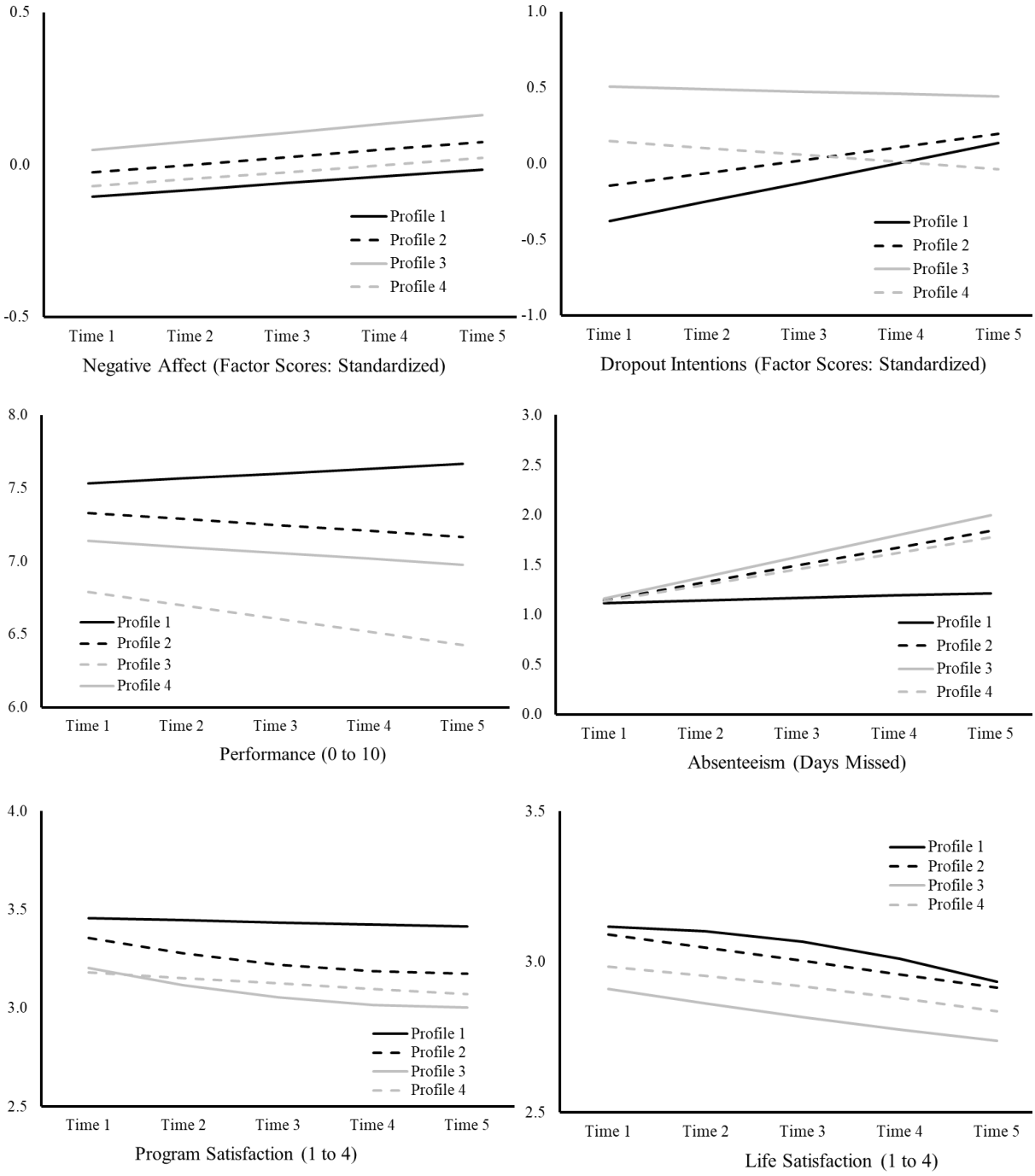

Figure 2. Profile-Specific Outcome Trajectories

Note. Profile 1: High and Stable; Profile 2: Moderate and Decreasing; Profile 3: Low and Decreasing; and Profile 4: Low and Stable.

Table 1

Results from the Growth Mixture Analyses

Model	*LL*	*#fp*	Scaling	AIC	CAIC	BIC	ABIC	Entropy	aLMR	BLRT
Profiles of Engagement Trajectories										
1 Profile	-7732.813	6	2.6928	15477.627	15518.607	15512.607	15493.543	Na	Na	Na
2 Profiles	-6424.479	10	1.3785	12868.959	12937.259	12927.259	12895.486	.826	≤ .001	≤ .001
3 Profiles	-6271.062	14	1.5452	12570.125	12665.745	12651.745	12607.263	.839	.002	≤ .001
4 Profiles	-6171.965	18	1.3761	12379.929	12502.870	12484.870	12427.679	.822	≤ .001	≤ .001
5 Profiles	-6048.278	22	1.3752	12140.556	12290.816	12268.816	12198.916	.768	≤ .001	≤ .001
6 Profiles	-6040.092	26	1.3458	12132.184	12309.765	12283.765	12201.156	.850	.500	1.000
7 Profiles	-5895.695	30	1.3225	11851.390	12056.291	12026.291	11930.973	.856	.026	≤ .001
8 Profiles	-5862.488	34	1.2489	11792.976	12025.197	11991.197	11883.170	.853	.020	≤ .001
Demographic Predictors										
D0. Null	-19771.867	47	1.3468	39637.733	39966.258	39919.258	39769.922	.738	Na	Na
D1. C	-19723.261	71	1.2306	39588.522	40084.805	40013.805	39788.211	.742	Na	Na
D2. I (inv.)	-19679.147	55	1.2958	39468.295	39852.739	39797.739	39622.983	.743	Na	Na
D3. I (var.)	-19633.625	79	1.2211	39425.249	39977.451	39898.451	39647.438	.733	Na	Na
D4. I (inv.), S (inv.)	-19658.065	63	1.2262	39442.130	39882.494	39819.494	39619.319	.741	Na	Na
D5. I (inv.); Final model with 2 predictors	-19687.863	49	1.3365	39473.726	39816.231	39767.231	39611.540	.742	Na	Na
Theoretical Predictors										
PO. Null	-12849.156	101	1.8706	25900.312	26606.292	26505.292	26184.377	.744	Na	Na
P1. Intercept predicting C	-12712.790	116	1.7685	25657.579	26468.408	26352.408	25983.832	.750	Na	Na
P2. Intercept predicting C, I (inv.)	-12595.457	121	1.7730	25432.914	26278.692	26157.692	25773.229	.756	Na	Na
P3. Intercept predicting C, I (inv.), S (inv.)	-12538.982	126	1.7676	25329.965	26210.692	26084.692	25684.343	.756	Na	Na
P4. Intercept predicting C, I (var.), S (inv.)	-12348.195	141	1.9045	24978.390	25963.966	25822.966	25374.956	.804	Na	Na
P5. Intercept predicting C, I (var.), S (var.)	-12266.390	156	1.9079	24844.780	25935.204	25779.204	25283.533	.801	Na	Na
P6. P5 + Slope predicting C	-12384.781	171	1.5683	25111.562	26306.835	26135.835	25592.503	.768	Na	Na
P7. P5 + Slope predicting S (inv.)	-12081.173	161	1.9169	24484.346	25609.720	25448.720	24937.162	.799	Na	Na
P7. P5 + Slope predicting S (var.)	-11680.369	176	1.8402	23712.737	24942.960	24766.960	24207.742	.804	Na	Na

Note. LL: Loglikelihood*; #fp*: Number of free parameters; Scaling = scaling factor; AIC: Akaïke Information Criteria; CAIC: Constant AIC; BIC: Bayesian Information Criteria; ABIC: Sample-Size adjusted BIC; aLMR: Adjusted Lo-Mendel-Rubin likelihood ration test; BLRT: Bootstrap likelihood ration test; C: Profile membership; I: Intercept factor; S: Slope factor; Na: Not applicable.

Table 2

Parameter Estimates for the Final Unconditional Growth Mixture Solution Including Four Profiles

	Profile 1 (High and Stable) Estimate (*t*)	Profile 2 (Moderate and Decreasing) Estimate (*t*)	Profile 3 (Low and Decreasing) Estimate (*t*)	Profile 4 (Low and Stable) Estimate (*t*)
Intercept mean	.565 (11.134)**	.010 (.587)	-.828 (-10.780)**	-.597 (-11.442)**
Slope mean	.000 (.043)	-.114 (-52.240)**	-.101 (-8.924)**	-.022 (-6.118)**
Intercept variability (SD = √σ)	.669 (21.997)**	.669 (21.997)**	.669 (21.997)**	.669 (21.997)**
Slope variability (SD = √σ)	.032 (> 100)**	.032 (> 100)**	.032 (> 100)**	.032 (> 100)**
Intercept-slope correlation	-.028 (-39.667)**	-.028 (-39.667)**	-.028 (-39.667)**	-.028 (-39.667)**
SD(εyi)_T1-T5	.197 (4.543)**	.235 (30.345)**	.633 (11.829)**	.105 (9.476)**

Note. * $p \leq .05$; ** $p \leq .01$; t = Estimate / standard error of the estimate (t values are computed from the original variance estimate and not from the square root); SD(εyi) = Standard deviation of the time-specific residual; the square root of the estimate of variability (trajectory factor and time-specific residual) is presented so that the results can be interpreted in the same unit as the construct used in the model (standardized factor score with M = 0 and SD = 1).

Table 3

Results from the Predictive Analyses

	Profile 1 vs 2		Profile 1 vs 3		Profile 1 vs 4		Profile 2 vs 3		Profile 2 vs 4		Profile 3 vs 4	
	Coeff (SE)	OR	Coeff (SE)	OR	Coeff (SE)	OR	Coeff (SE)	OR	Coeff (SE)	OR	Coeff (SE)	OR
Predicting Profile Membership												
Institutional support (Int.)	.068 (.094)	1.070	.069 (.123)	1.071	.211 (.143)	1.235	.001 (.103)	1.001	.143 (.128)	1.154	.142 (.141)	1.152
Harmonious passion (Int.)	-.415 (.175)*	.661	.630 (.226)**	1.877	.493 (.251)*	1.638	1.045 (.198)**	2.842	.908 (.249)**	2.479	-.137 (.267)	.872
Obsessive passion (Int.)	-.096 (.153)	.908	.383 (.205)	1.467	-.141 (.256)	.868	.480 (.180)**	1.616	-.045 (.237)	.956	-.524 (.254)*	.592
Challenge demands (Int.)	.775 (.180)**	2.172	1.006 (.238)**	2.735	1.101 (.305)**	3.007	.231 (.188)	1.259	.326 (.275)	1.385	.095 (.289)	1.100
Hindrance demands (Int.)	-.020 (.120)	.980	-.275 (.167)	.760	.179 (.232)	1.196	-.254 (.129)*	.776	.199 (.225)	1.220	.453 (.230)*	1.574
	Profile 1		Profile 2		Profile 3		Profile 4					
	b (s.e.)	*β*	*b* (s.e.)	*β*	*b* (s.e.)	*β*	*b* (s.e.)	*β*				
Predicting Within-Profile Intercepts												
Institutional support (Int.)	.070 (.046)	.080	.063 (.021)**	.066	.173 (.074)*	.166	.016 (.049)	.019				
Harmonious passion (Int.)	.084 (.068)	.068	.184 (.037)**	.137	.116 (.142)	.079	.074 (.140)	.061				
Obsessive passion (Int.)	.092 (.048)*	.080	.228 (.032)**	.184	.383 (.117)**	.281	-.054 (.092)	-.048				
Challenge demands (Int.)	.144 (.071)*	.108	.331 (.036)**	.231	.483 (.119)**	.307	.059 (.100)	.045				
Hindrance demands (Int.)	.003 (.052)	.003	-.042 (.030)	-.040	-.206 (.075)**	-.178	-.023 (.071)	-.024				
	Profile 1		Profile 2		Profile 3		Profile 4					
	b (s.e.)	*β*	*b* (s.e.)	*β*	*b* (s.e.)	*β*	*b* (s.e.)	*β*				
Predicting Within-Profile Slopes												
Institutional support (Int.)	-.009 (.007)	-.148	-.006 (.003)	-.089	-.014 (.014)	-.135	.018 (.005)**	.328				
Harmonious passion (Int.)	-.004 (.013)	-.050	-.008 (.005)	-.081	.003 (.028)	.023	-.003 (.012)	-.033				
Obsessive passion (Int.)	-.008 (.012)	-.093	.007 (.006)	.081	.012 (.026)	.091	.021 (.009)*	.284				
Challenge demands (Int.)	-.001 (.022)	-.015	-.020 (.007)**	-.203	-.057 (.023)*	-.371	-.006 (.008)	-.068				
Hindrance demands (Int.)	-.051 (.016)**	-.752	.002 (.006)	.033	-.009 (.021)	-.084	.013 (.008)	.207				
Institutional support (Slo.)	-.012 (.011)	-.133	.000 (.006)	-.004	.033 (.019)	.230	.048 (.008)**	.609				
Harmonious passion (Slo.)	-.233 (.190)	-.210	.385 (.125)**	.320	.440 (.245)	.240	-.096 (.065)	-.096				
Obsessive passion (Slo.)	.023 (.137)	.026	.468 (.138)**	.487	.608 (.297)*	.414	.155 (.072)*	.194				
Challenge demands (Slo.)	.078 (.032)*	.745	.024 (.011)*	.213	.087 (.024)**	.501	-.019 (.010)	-.201				
Hindrance demands (Slo.)	-.307 (.037)**	-.439	.071 (.022)**	.094	.167 (.054)**	.144	-.023 (.011)*	-.036				

Note. ** $p < .01$; * $p < .05$. Coef: Multinomial logistic regression coefficient (prediction of profile membership); b: Unstandardized regression coefficients (prediction of the intercept and slope factors); *β*: Unstandardized multiple coefficients (prediction of the intercept and slope factors); s.e.: Standard error of the coefficient; OR: Odds ratio; the multinomial logistic regression coefficients and OR reflect the predictor effects on the likelihood of membership in the bottom listed profile relative to the top listed profile; Int.: Intercept; Slo: Slope; Profile 1: High and Stable; Profile 2: Moderate and Decreasing; Profile 3: Low and Decreasing; and Profile 4: Low and Stable.

Table 4

Associations between Profile Membership and the Outcome Trajectories

		Profile 1 (High and Stable) Mean [95% CI]	Profile 2 (Moderate and Decreasing) Mean [95% CI]	Profile 3 (Low and Decreasing) Mean [95% CI]	Profile 4 (Low and Stable) Mean [95% CI]	Summary
Negative Affect	Intercept	-.105 [-.193; -.017]	-.026 [-.053; .001]	.047 [-.008; .102]	-.071 [-.151; .009]	3 > 1=2=4
(Factor Scores: Standardized)	Linear Slope	.022 [.016; .028]	.025 [.023; .027]	.029 [.025; .033]	.023 [.019; .027]	3 > 1=2=4
Dropout Intentions	Intercept	-.378 [-.452; -.304]	-.147 [-.182; -.112]	.506 [.404; .608]	.149 [.020; .278]	3 > 4 > 2 > 1
(Factor Scores: Standardized)	Latent Basis Slope	.128 [.057; .199]	.086 [.064; .108]	-.016 [-.053; .021]	-.046 [-.103; .011]	1=2 > 3=4
Performance	Intercept	7.531 [7.411; 7.651]	7.331 [7.290; 7.372]	6.788 [6.694; 6.882]	7.139 [7.010; 7.268]	1 > 2 > 4 > 3
(0 to 10)	Linear Slope	.034 [.014; .054]	-.041 [-.045; -.037]	-.090 [-.102; -.078]	-.041 [-.053; -.029]	1 > 2=4 > 3
Absenteeism	Intercept	1.116 [1.108; 1.124]	1.144 [1.136; 1.152]	1.158 [1.138; 1.178]	1.135 [1.119; 1.151]	2=3=4 > 1
(Days Missed)	Linear Slope	.025 [.011; .039]	.174 [.160; .188]	.209 [.164; .254]	.160 [.125; .195]	2=3=4 > 1
Program Satisfaction	Intercept	3.455 [3.412; 3.498]	3.355 [3.339; 3.371]	3.202 [3.169; 3.235]	3.181 [3.126; 3.236]	1 > 2 > 3=4
(1 to 4)	Linear Slope	-.010 [-.041; .021]	-.089 [-.097; -.081]	-.098 [-.114; -.082]	-.028 [-.057; .001]	1=4 > 2=3
	Quadratic Slope	.000 [-.006; .006]	.011 [.009; .013]	.012 [.008; .016]	.000 [-.006; .006]	2=3 > 1=4
Life Satisfaction	Intercept	3.118 [3.047; 3.189]	3.091 [3.067; 3.115]	2.911 [2.862; 2.960]	2.985 [2.909; 3.061]	1=2 > 3=4
(1 to 4)	Linear Slope	-.006 [-.033; .021]	-.044 [-.052; -.036]	-.051 [-.067; -.035]	-.029 [-.054; -.004]	1 > 2=3; 2=3=4; 1=4
	Quadratic Slope	-.010 [-.016; -.004]	.000 [-.002; .002]	.002 [-.002; .006]	-.002 [-.006; .002]	2=3=4 > 1

Note. CI: 95% confidence interval.

Online Supplemental Materials for:

Predictors and Outcomes of Nursing Students' Engagement Trajectories at the Beginning of their Program

Preliminary Measurement Models: Estimation

Preliminary measurement models were estimated using Mplus 8.8 (Muthén & Muthén, 2022) and the robust Maximum Likelihood (MLR) estimator (for engagement, demands, institutional support, and dropout intentions) which provides parameter estimates, standard errors, and goodness-of-fit indices that are robust to the non-normality of the response scales used in the present study. The mean and variance adjusted weight least square estimator (WLSMV; relying on a theta parameterization) was also used to account for the ordered-categorical Likert ratings used in this research (Finney & DiStefano, 2013) for passion and negative affect. All models estimated with MLR relied on Full Information Maximum Likelihood (FIML) procedures to handle missing data (Enders, 2010), whereas all models estimated using WLSMV relied on similar missing data procedures, albeit slightly less efficient than FIML, implemented in Mplus for this estimator (Asparouhov & Muthén, 2010). Due to the complexity of the models underlying all constructs assessed in this study, preliminary analyses were conducted separately for the engagement, passion, demands, institutional support, dropout intentions, and negative affect measures. Importantly, WLSMV estimation was only used to generate factor scores for participants who completed each time of measurement, allowing us to relying on FIML procedures to handle attrition on these variables as part of our main analyses.

For the engagement measure, a bifactor-exploratory structural equation modeling (ESEM) model (Morin et al., 2016, 2020) including one engagement global (G-) factor and three orthogonal specific (S-) factors (physical, emotional, and cognitive) was estimated. This specification is aligned with accumulating research evidence supporting a bifactor representation of engagement ratings (e.g., Gillet et al., 2019, 2020; Houle et al., 2022; Huyghebaert-Zouaghi et al., 2021a, 2021b), which makes it possible to simultaneously assess respondents' global levels of engagement (G-factor; defined by all engagement items) while accounting for the specificity associated with each engagement subscale. This model also freely estimated all cross-loadings among the subscale-specific factors, which were however assigned a target value of zero using an oblique target rotation (Browne, 2001).

Following Marsh et al. (2013) and Tóth-Király et al.'s (2017) recommendations, we relied on an ESEM specification for the passion measure, allowing for the free estimation of all cross-loadings between the harmonious and obsessive subscales, which were assigned a target value of zero using an oblique target rotation (Browne, 2001). We relied on a similar specification for the challenge and hindrance demands measure, to account for the conceptually related nature of the two subscales included in this measure (Morin et al., 2016, 2020). For the other multi-item predictor (institutional support) and outcomes (negative affect and dropout intentions), confirmatory factor analytic models were estimated. One a priori correlated uniqueness was added at each time point to account for the negative wording of two items from the institutional support scale (Marsh et al., 2010). All models included *a priori* correlated uniquenesses between matching indicators over time to avoid inflated stability estimates (Marsh, 2007).

We verified that these models operated in the same manner over time through sequential tests of measurement invariance (Millsap, 2011). More precisely, we assessed: (1) configural invariance; (2) weak invariance (loadings); (3) strong invariance (loadings and intercepts or thresholds with WLSMV estimation); (4) strict invariance (loadings, intercepts/thresholds, and uniquenesses); (5) invariance of the latent variances and covariances (loadings, intercepts/thresholds, uniquenesses, and latent variances and covariances); and (6) latent means invariance (loadings, intercepts/thresholds, uniquenesses, latent variances and covariances, and latent means). For the institutional support model, a step was added between (4) and (5) to test the invariance of the a priori correlated uniqueness added to account for the negative wording of two of the items (Marsh, 2007).

Given the known oversensitivity of the chi-square test of exact fit (χ^2) to sample size and minor model misspecifications (e.g., Marsh et al., 2005), we relied on sample-size independent goodness-of-fit indices to describe the fit of the alternative models (Hu & Bentler, 1999): The comparative fit index (CFI), the Tucker-Lewis index (TLI), as well as the root mean square error of approximation (RMSEA) and its 90% confidence interval. Values greater than .90 for the CFI and TLI indicate adequate model fit, although values greater than .95 are preferable. Values smaller than .08 or .06 for the RMSEA respectively support acceptable and excellent model fit. Like the chi-square, chi-square difference tests present a known sensitivity to sample size and minor model misspecifications so that recent studies suggest complementing this information with changes in CFIs and RMSEAs (Chen, 2007; Cheung & Rensvold, 2002) in the context of tests of measurement invariance. A ΔCFI of .010 or less, a ΔTLI of .010 or less, and a ΔRMSEA of .015 or less between a more restricted model and the previous one

support the invariance hypothesis.

Preliminary Measurement Models: Results

The fit of all engagement models is reported in Table S1. These results support the adequacy of the a priori bifactor-ESEM model underlying the engagement measure (with all CFI and TLI ≥ .95, and all RMSEA ≤ .05) and its configural, weak, strong, strict, and latent variance-covariance invariance, but not its latent means invariance. Indeed, the results show a decreasing tendency in participants' global levels of engagement over time (particularly marked between T1 and T3), starting from a standardized mean of 0 at T1, to one of -.328 SD at T2, -.486 SD at T3, -.411 SD at T4, and -.445 SD at T5. Parameter estimates from this final model are reported in Table S2 and revealed a reliable G-factor (ω = .944) adequately defined by strong positive loadings from the physical (λ = .719 to .846; M_λ =.790), emotional (λ = .571 to .671; M_λ = .617), and cognitive (λ = .667 to .831; M_λ = .759) items.

The goodness-of-fit of the predictor and outcome models are also reported in Table S1 and support the adequacy of our a priori models. In terms of measurement invariance, the results supported the configural, weak, strong, and strict invariance of all measures, thus supporting their comparability over time. They also supported the invariance of the latent variance-covariance and latent means invariance of the passion, dropout intentions and negative affect measures, the latent variance-covariance and partial latent means invariance of the demands measure (consistent with an increase in levels of hindrance demands occurring between T1 [0], T2 [+.161 SD], and T3 [+ .456 SD] which remained stable thereafter), as well as the partial latent variance-covariance and partial means invariance of the institutional support measure. For this last measure, the results indicate that the variance of the institutional support measure increased between T1 (1) and T2 (1.471) and remained stable thereafter, while the mean of this measure progressively decreased from T1 (0), to T2 (-.318 SD) and to T3 (-.578 SD) and remained stable afterwards. Parameter estimates from the most invariant models are reported in Tables S3 (predictors) and S4 (outcomes). These results revealed well-defined factors: Harmonious passion (λ =.782 to .874; M_λ = .824; ω = .867), obsessive passion (λ = .591 to .802; M_λ = .729; ω = .795), challenge demands (λ = .494 to .739; M_λ = .637; ω = .679), hindrance demands (λ =.415 to .805; M_λ = .640; ω = .687), and institutional support (λ = .393 to .858; M_λ = .626; ω_{t1} = .695; $\omega_{t2\text{-}t5}$ = .762). Correlations obtained between all variables (i.e., factor scores and single-item measures) are reported in Table S5.

Lastly, we calculated the intraclass correlation coefficient (ICC) for all of our repeated measures. The ICC indicates the proportion of the total variance in rating occurring at the between person level (thus 1 – ICC indicates the proportion of the total variance occurring at the within-person level) and is calculated as (Morin et al., 2022):

$$ICC = \frac{\tau_x^2}{\tau_x^2 + \sigma_x^2}$$

where τ_x^2 refers to the between variance, σ_x^2 to the within variance

All of those are consistent with the presence of substantial variability at both levels: (a) engagement ICC = .788; (b) challenges ICC = .894; (c) hindrances ICC = .836; (d) institutional support ICC = .900; (e) harmonious passion ICC = .570; (f) obsessive passion ICC = .629; (g) negative affect ICC = .654; (h) dropout intentions ICC = .865; (i) performance ICC = .484; (j) absenteeism ICC = .150; (k) program satisfaction ICC = .341; and (l) life satisfaction ICC = .497.

Preliminary Latent Curve Models for the Predictors and Outcomes

Using the scores on the factors obtained from the preliminary measurement models described in the previous sections in these online supplements, we proceed to estimate latent curve models to represent participants' trajectories across all predictors and outcomes considered in this study (Bollen & Curran, 2006). These analyses entailed the comparison of linear, quadratic, and latent basis (nonlinear) trajectories (Grimm et al., 2016) specified according to the procedures described in the Preliminary Measurement Models subsection of the Analyses section of the main manuscript. These alternative specifications were contrasted while considering model fit indices (using procedure similar to those described in the earlier sections of these online supplements), while also considering their parameters estimates (i.e., whether the mean and variance of the trajectories were truly consistent with the shape of the model being estimated). The model fit results from these analyses are reported in Table S6 of these online supplements, while the parameter estimates from the final models retained are reported in Tables S7 (predictors) and S8 (outcomes).

These model comparisons led us to retain the most parsimonious linear specification for the harmonious passion, obsessive passion, negative affect, performance, and absenteeism measures (for all of these comparisons, none of the alternative models provided any evidence of nonlinearity). Whereas levels of harmonious passion displayed a small decreasing tendency over time, those of obsessive passion and performance remained stable on the average but displayed a rate of change that varied significantly across participants, and those of negative affect and absenteeism displayed a small increasing tendency over time. A quadratic trajectory was retained for life satisfaction and program satisfaction, mainly as a result of the presence of significant inter-individual variability in terms of curvilinearity, although both variables followed, on the average, mainly linear decreasing trajectories. Finally, a latent basis solution was retained for challenge demands, hindrance demands, institutional support, and dropout intentions. For this last variable, the results were consistent with an increasing trajectory that was particularly marked between T1 and T3 before becoming less pronounced until the end of the study. For the remaining three variables, an examination of the results suggested that all loadings (time scores) on the slope factor did not need to be freely estimated, leading us to estimate more parsimonious latent basis models. For hindrance demands and institutional support, the resulting model was consistent with a marked increase occurring between T1 and T3, followed by stable trajectories. For challenge demands, the results were consistent with a marked increase between T1 and T2, followed by a similar decrease until T3, and then going back up until the end of the study- possibly reflecting events specific to the training context.

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Table S1

Preliminary Measurement Models: Fit statistics

Description	χ^2 (*df*)	CFI	TLI	RMSEA	90% CI	$\Delta\chi^2$ (*df*)	ΔCFI	ΔTLI	ΔRMSEA
Engagement									
Longitudinal B-ESEM: Configural invariance	946.653 (644)*	.983	.974	.014	[.012; .015]	-	-	-	-
Longitudinal B-ESEM: Weak invariance	1092.558 (724)*	.980	.972	.014	[.012; .016]	136.309 (80)*	-.003	-.002	.000
Longitudinal B-ESEM: Strong invariance	1126.847 (744)*	.979	.972	.014	[.013; .016]	34.739 (20)*	-.001	.000	.000
Longitudinal B-ESEM: Strict invariance	1196.057 (780)*	.977	.971	.015	[.013; .016]	62.176 (36)*	-.002	-.001	+.001
Longitudinal B-ESEM: Variance-Covariance invariance	1415.823 (820)*	.967	.962	.017	[.015; .018]	155.660 (40)*	-.010	-.009	+.002
Longitudinal B-ESEM: Latent means invariance	1656.637 (836)*	.955	.947	.020	[.018; .021]	285.256 (16)*	-.012	-.015	+.003
Passion									
Longitudinal ESEM: Configural invariance	912.605 (316)*	.965	.952	.031	[.028; .033]	-	-	-	-
Longitudinal ESEM: Weak invariance	922.132 (348)*	.967	.958	.029	[.026; .031]	71.789 (32)*	+.002	+.006	-.002
Longitudinal ESEM: Strong invariance	1126.081 (460)*	.961	.963	.027	[.025; .029]	264.047 (112)*	-.006	+.005	-.002
Longitudinal ESEM: Strict invariance	1165.232 (484)*	.960	.964	.026	[.025; .028]	71.280 (24)*	-.001	+.001	-.001
Longitudinal ESEM: Variance-Covariance invariance	1155.056 (496)*	.962	.966	.026	[.024; .028]	43.930 (12)*	+.002	+.002	.000
Longitudinal ESEM: Latent means invariance	1249.528 (504)*	.957	.963	.027	[.025; .029]	57.771 (8)*	-.005	-.003	+.001
Demands									
Longitudinal ESEM: Configural invariance	541.194 (316)*	.946	.926	.019	[.016; .022]	-	-	-	-
Longitudinal ESEM: Weak invariance	564.918 (348)*	.948	.935	.018	[.015; .020]	27.459 (32)	+.002	+.009	-.001
Longitudinal ESEM: Strong invariance	603.466 (364)*	.943	.932	.018	[.016; .021]	40.180 (16)*	-.005	-.003	.000
Longitudinal ESEM: Strict invariance	667.742 (388)*	.933	.925	.019	[.017; .022]	59.572 (24)*	-.010	-.007	+.001
Longitudinal ESEM: Variance-Covariance invariance	681.376 (400)*	.933	.927	.019	[.016; .021]	13.218 (12)	.000	+.002	.000
Longitudinal ESEM: Latent means invariance	788.095 (408)*	.909	.903	.022	[.019; .024]	115.337 (8)*	-.024	-.024	+.003
Longitudinal ESEM: Partial latent means invariance	686.513 (404)*	.933	.927	.019	[.016; .021]	4.920 (4)	.000	.000	.000
Institutional support									
Longitudinal CFA: Configural invariance	353.119 (139)*	.945	.924	.024	[.021; .027]	-	-	-	-
Longitudinal CFA: Weak invariance	370.264 (151)*	.943	.929	.024	[.021; .027]	17.676 (12)*	+.002	+.005	.000
Longitudinal CFA: Strong invariance	383.737 (163)*	.943	.933	.023	[.020; .026]	11.011 (12)	.000	+.004	-.001
Longitudinal CFA: Strict invariance	392.999 (179)*	.945	.941	.021	[.019; .024]	19.127 (16)	+.002	+.008	-.002
Longitudinal CFA: Correlated uniquenesses invariance	394.180 (183)*	.945	.943	.021	[.018; .024]	3.599 (4)	.000	+.002	.000
Longitudinal CFA: Variance-Covariance invariance	459.595 (187)*	.929	.928	.024	[.021; .026]	60.449 (4)*	-.013	-.015	+.003
Longitudinal CFA: Partial variance-Covariance invariance	422.788 (186)*	.939	.937	.022	[.019; .025]	30.122 (3)*	-.006	-.007	+.001
Longitudinal CFA: Latent means invariance	578.468 (190)*	.899	.899	.028	[.025; .031]	144.896 (16)*	-.040	-.038	+.006
Longitudinal CFA: Partial latent means invariance	431.250 (188)*	.937	.936	.022	[.019; .025]	9.222 (2)*	-.002	-.001	.000

Description	χ^2 (*df*)	CFI	TLI	RMSEA	90% CI	$\Delta\chi^2$ (*df*)	ΔCFI	ΔTLI	ΔRMSEA
Dropout intentions									
Longitudinal CFA Configural invariance	86.081 (68)	.996	.994	.011	[.000; .018]	-	-	-	-
Longitudinal CFA: Weak invariance	89.341 (76)	.997	.996	.009	[.000; .016]	2.882 (8)	+.001	+.002	-.002
Longitudinal CFA: Strong invariance	97.960 (84)	.997	.996	.009	[.000; .016]	8.282 (8)	.000	.000	.000
Longitudinal CFA: Strict invariance	97.757 (96)	1.000	1.000	.003	[.000; .012]	7.741 (12)	+.003	+.004	-.006
Longitudinal CFA: Variance-Covariance invariance	128.505 (100)*	.994	.993	.012	[.004; .017]	39.222 (4)*	-.006	-.007	+.009
Longitudinal CFA: Latent means invariance	177.824 (104)*	.984	.984	.019	[.014; .023]	86.518 (4)*	-.010	-.009	+.007
Negative affect									
Longitudinal CFA: Configural invariance	1441.304 (245)*	.923	.905	.047	[.044; .049]	-	-	-	-
Longitudinal CFA: Weak invariance	1460.522 (261)*	.922	.911	.045	[.043; .048]	10.305 (16)	-.001	+.006	-.002
Longitudinal CFA: Strong invariance	1525.945 (317)*	.922	.926	.041	[.039; .043]	68.405 (56)	.000	+.015	-.004
Longitudinal CFA: Strict invariance	1493.806 (337)*	.925	.933	.039	[.037; .041]	50.250 (20)*	+.003	+.007	-.002
Longitudinal CFA: Variance-Covariance invariance	1465.007 (341)*	.927	.936	.038	[.036; .040]	21.186 (4)*	+.002	+.003	-.001
Longitudinal CFA: Latent means invariance	1391.470 (345)*	.932	.941	.037	[.035; .039]	2.204 (4)	+.005	+.005	-.001

Note. * $p < .05$; CFA: Confirmatory factor analysis; ESEM: Exploratory structural equation modeling; B-ESEM: Bifactor-ESEM χ^2: Robust chi-square test of exact fit; *df*: Degrees of freedom; CFI: Comparative fit index; TLI: Tucker-Lewis index; RMSEA: Root mean square error of approximation; 90% CI: 90% confidence interval; Δ: Change in fit relative to the comparison model.

Table S2

Standardized Factor Loadings (λ) and Uniquenesses (δ) from the Bifactor-ESEM Solution

(Engagement)

Items	G-Engagement λ	S-Physical λ	S-Emotional λ	S-Cognitive λ	δ
Physical					
Item 1	**.804**	**.317**	-.070	-*.027*	.247
Item 2	**.719**	**.399**	*.041*	.182	.289
Item 3	**.846**	***.104***	-*.015*	-.061	.270
Emotional					
Item 1	**.609**	-*.003*	**.505**	*.026*	.374
Item 2	**.571**	-*.041*	**.594**	-.057	.317
Item 3	**.671**	*.010*	**.566**	-*.050*	.226
Cognitive					
Item 1	**.831**	*.136*	-.119	***-.008***	.276
Item 2	**.667**	-.140	.169	**-.160**	.481
Item 3	**.779**	*.027*	*.004*	***.617***	*.012*
ω	.944	.398	.751	.445	

Note. G = Global factor estimated as part of a bifactor model; S = Specific factor estimated as part of a bifactor model; λ: Factor loading; δ: Item uniqueness; ω: Omega coefficient of model-based composite reliability; target factor loadings are indicated in bold; non-significant parameters ($p \geq .05$) are marked in italics.

Table S3

Standardized Factor Loadings (λ) and Uniquenesses (δ) from the CFA and ESEM Solutions (Predictors)

Items	Harmonious passion λ	Obsessive passion λ	Challenge demands λ	Hindrance demands λ	Institutional support T1 λ	Institutional support T2 T3 T4 T5 λ	δ
Harmonious passion							
Item 1	**.782**	*.022*					.378
Item 2	**.874**	.019					.226
Item 3	**.817**	*-.006*					.335
Obsessive passion							
Item 1	.126	**.802**					.286
Item 2	.216	**.591**					.532
Item 3	-.307	**.794**					.412
Challenge demands							
Item 1			**.739**	-.075			.500
Item 2			**.678**	.092			.474
Item 3			**.494**	*.011*			.751
Hindrance demands							
Item 1			.087	**.805**			.278
Item 2			-.055	**.700**			.544
Item 3			-.109	**.415**			.858
Institutional support							
Item 1					.809	.858	.345 / .264
Item 2					.474	.547	.775 / .701
Item 3					.700	.765	.510 / .415
Item 4					.393	.461	.845 / .788
ω	.867	.795	.679	.687	.695	.762	

Note. λ: Factor loading; δ: Item uniqueness; ω: Omega coefficient of model-based composite reliability; T1 T2 T3 T4 T5: Time 1, Time 2, Time 3, Time 4, and Time 5; target factor loadings are indicated in bold; non-significant parameters ($p \geq .05$) are marked in italics.

Table S4

Standardized Factor Loadings (λ) and Uniquenesses (δ) from the CFA Solutions (Outcomes)

	Dropout intentions	Negative affect	
Items	λ	λ	δ
Dropout intentions			
Item 1	.902		.187
Item 2	.890		.207
Item 3	.930		.136
Negative affect			
Item 1		.708	.499
Item 2		.581	.663
Item 3		.616	.621
Item 4		.814	.337
Item 5		.836	.301
ω	.933	.839	

Note. λ: Factor loading; δ: Item uniqueness; ω: Omega coefficient of model-based composite reliability; all parameters are significant ($p < .05$).

Table S5. *Correlations between Variables*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Global engagement (T1)	-																		
2. Global engagement (T2)	.790**	-																	
3. Global engagement (T3)	.819**	.908**	-																
4. Global engagement (T4)	.744**	.856**	.930**	-															
5. Global engagement (T5)	.808**	.868**	.851**	.889**	-														
6. Harmonious passion (T1)	.380**	.310**	.365**	.360**	.316**	-													
7. Obsessive passion (T1)	.315**	.307**	.331**	.328**	.301**	.389**	-												
8. Challenge demands (T1)	.296**	.287**	.294**	.272**	.285**	.050	.347**	-											
9. Hindrance demands (T1)	-.046*	-.014	-.031	-.025	-.016	-.279**	.207**	.566**	-										
10. Institutional support (T1)	.199**	.174**	.176**	.169**	.175**	.277**	.032	-.019	-.238**	-									
11. Dropout intentions (T1)	-.374**	-.308**	-.356**	-.362**	-.312**	-.453**	-.127**	.088**	.361**	-.249**	-								
12. Negative affect (T1)	-.048	-.064*	-.065*	-.071**	-.048	-.167**	.153**	.226**	.381**	-.130**	.271**	-							
13. Performance (T1)	.203**	.155**	.175**	.148**	.161**	.250**	.027	-.124**	-.249**	.131**	-.283**	-.184**	-						
14. Absenteeism (T1)	-.041	-.019	-.006	-.009	-.036	-.022	.020	.019	.050	-.070**	.087**	.084**	-.061*	-					
15. Program satisfaction (T1)	.342**	.272**	.311**	.303**	.268**	.363**	.145**	.041	-.167**	.298**	-.400**	-.089**	.231**	-.061*	-				
16. Life satisfaction (T1)	.225**	.173**	.200**	.183**	.173**	.240**	.050	-.041	-.252**	.186**	-.280**	-.324**	.210**	-.088**	.448**	-			
17. Harmonious passion (T2)	.327**	.402**	.390**	.365**	.350**	.596**	.149**	.040	-.271**	.238**	-.423**	-.271**	.252**	.035	.301**	.256**	-		
18. Obsessive passion (T2)	.328**	.364**	.340**	.347**	.352**	.151**	.648**	.353**	.251**	.002	-.070	.161**	-.066	.016	.164**	.014	.309**	-	
19. Challenge demands (T2)	.310**	.340**	.343**	.332**	.332**	.062*	.352**	.879**	.510**	-.022	.068**	.230**	-.144**	.033	.052	-.035	.081*	.437**	-
20. Hindrance demands (T2)	-.035	-.059**	-.068**	-.068**	-.037	-.229**	.210**	.484**	.852**	-.230**	.344**	.382**	-.249**	.050	-.135**	-.226**	-.321**	.254**	.551**
21. Institutional support (T2)	.168**	.193**	.192**	.192**	.193**	.269**	.040	-.041	-.239**	.888**	-.237**	-.144**	.131**	-.060*	.271**	.183**	.297**	.026	-.048*
22. Dropout intentions (T2)	-.347**	-.384**	-.407**	-.415**	-.353**	-.432**	-.122**	.073**	.327**	-.241**	.892**	.268**	-.261**	.068*	-.362**	-.275**	-.539**	-.128**	.064**
23. Negative affect (T2)	-.053	-.117**	-.110**	-.106**	-.064	-.226**	.192**	.238**	.386**	-.169**	.305**	.628**	-.246**	.118*	-.084	-.329**	-.237**	.271**	.260**
24. Performance (T2)	.267**	.379**	.360**	.316**	.306**	.251**	.034	-.085*	-.271**	.165**	-.378**	-.290**	.501**	-.036	.154**	.255**	.341**	.080*	-.074
25. Absenteeism (T2)	-.125**	-.149**	-.125**	-.136**	-.117**	.087	.027	-.039	.018	-.043	.008	.010	-.009	.097	.040	.035	.011	-.070	-.052
26. Program satisfaction (T2)	.301**	.397**	.390**	.331**	.275**	.294**	.103	-.042	-.238**	.262**	-.340**	-.238**	.224**	-.023	.346**	.208**	.422**	.154**	-.031
27. Life satisfaction (T2)	.213**	.275**	.297**	.269**	.211**	.183**	-.058	-.090*	-.293**	.180**	-.250**	-.310**	.115*	-.118*	.069	.525**	.275**	-.032	-.085*
28. Harmonious passion (T3)	.214**	.206**	.325**	.304**	.207**	.558**	.068	-.106*	-.392**	.305**	-.442**	-.257**	.181**	-.020	.166*	.199**	.631**	.056	-.093*
29. Obsessive passion (T3)	.358**	.379**	.408**	.421**	.396**	.150*	.607**	.325**	.204**	-.071	-.158**	.154*	-.068	-.008	.129*	.018	.135*	.647**	.364**
30. Challenge demands (T3)	.325**	.356**	.381**	.365**	.368**	.086**	.325**	.783**	.417**	-.015	.002	.168**	-.099**	.000	.072**	-.010	.105**	.358**	.860**
31. Hindrance demands (T3)	-.047*	-.045*	-.050*	-.046*	-.024	-.261**	.179**	.398**	.856**	-.251**	.327**	.367**	-.241**	.042	-.148**	-.236**	-.314**	.238**	.481**
32. Institutional support (T3)	.143**	.163**	.177**	.176**	.175**	.260**	.030	-.050*	-.241**	.792**	-.228**	-.149**	.118**	-.073**	.237**	.173**	.283**	-.022	-.055*
33. Dropout intentions (T3)	-.318**	-.351**	-.412**	-.414**	-.337**	-.409**	-.103**	.071**	.322**	-.237**	.799**	.254**	-.239**	.067*	-.323**	-.260**	-.518**	-.105**	.068**
34. Negative affect (T3)	.001	-.072	-.098*	-.103*	-.015	-.176**	.143*	.232**	.407**	-.236**	.271**	.639**	-.097	.061	-.108	-.310**	-.271**	.217**	.235**
35. Performance (T3)	.317**	.374**	.437**	.420**	.338**	.305**	.021	-.030	-.355**	.205**	-.416**	-.370**	.335**	-.049	.227**	.394**	.344**	.043	.009
36. Absenteeism (T3)	-.150**	-.173**	-.145**	-.182**	-.166**	.097	.049	-.037	.098*	-.007	.038	.029	.050	.102	.093	-.041	-.052	-.074	-.048
37. Program satisfaction (T3)	.253**	.288**	.347**	.327**	.269**	.279**	-.024	-.044	-.329**	.340**	-.394**	-.218**	.079	.054	.266**	.225**	.492**	.159*	-.017
38. Life satisfaction (T3)	.129**	.189**	.217**	.224**	.178**	.189**	-.129*	-.048	-.317**	.256**	-.308**	-.328**	.108	-.010	.039	.421**	.396**	.041	-.039
39. Harmonious passion (T4)	.159*	.124	.211**	.265**	.222**	.488**	.108	-.078	-.342**	.255**	-.367**	-.195*	.077	-.095	.212*	.105	.752**	.224*	.013
40. Obsessive passion (T4)	.394**	.376**	.425**	.476**	.466**	.241**	.590**	.363**	.259**	-.020	-.057	.165	-.109	.050	.134	-.066	.065	.708**	.409**
41. Challenge demands (T4)	.354**	.385**	.397**	.381**	.377**	.116**	.358**	.878**	.423**	.008	.002	.173**	-.101**	.010	.084**	.001	.152**	.408**	.944**
42. Hindrance demands (T4)	-.035	-.054*	-.049*	-.045*	-.017	-.240**	.186**	.451**	.857**	-.237**	.330**	.363**	-.241**	.040	-.139**	-.229**	-.342**	.201**	.494**
43. Institutional support (T4)	.138**	.165**	.177**	.178**	.178**	.254**	.038	-.052*	-.233**	.768**	-.219**	-.139**	.109**	-.079**	.226**	.166**	.286**	-.009	-.056*
44. Dropout intentions (T4)	-.319**	-.330**	-.384**	-.403**	-.338**	-.411**	-.097**	.081**	.330**	-.233**	.810**	.253**	-.247**	.078**	-.337**	-.251**	-.517**	-.115**	.068**
45. Negative affect (T4)	.145*	.062	.078	.043	.099	-.074	.341**	.364**	.462**	-.230**	.245**	.539**	-.259**	.148	-.005	-.211*	-.181*	.393**	.353**
46. Performance (T4)	.213**	.261**	.217**	.251**	.248**	.174	-.011	-.113	-.302**	.214**	-.339**	-.333**	.207*	-.037	.186*	.198*	.356**	.011	-.078
47. Absenteeism (T4)	-.058	-.083	-.119	-.058	-.009	.114	.073	-.119	-.012	-.008	-.071	.004	.080	.034	-.022	-.063	-.032	.005	-.099
48. Program satisfaction (T4)	.248**	.244**	.333**	.331**	.310**	.397**	.126	-.048	-.318**	.358**	-.408**	-.213*	.089	-.161	.203*	.111	.560**	.239**	.043
49. Life satisfaction (T4)	.001	.059	.050	.055	.060	.099	-.199*	-.134*	-.338**	.220**	-.249**	-.311**	.146	-.080	.021	.409**	.353**	.053	-.096
50. Harmonious passion (T5)	.271**	.222**	.265**	.316**	.391**	.528**	.137	-.032	-.292**	.404**	-.414**	-.209*	-.004	-.176	.177	.060	.600**	.086	-.012
51. Obsessive passion (T5)	.400**	.367**	.419**	.452**	.453**	.205*	.598**	.496**	.315**	.056	-.062	.136	-.231*	-.042	.156	.043	.082	.553**	.481**
52. Challenge demands (T5)	.346**	.356**	.376**	.351**	.359**	.111**	.353**	.902**	.434**	.001	.010	.174**	-.094**	.005	.083**	.000	.103**	.382**	.904**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
53. Hindrance demands (T5)	-.054*	-.077**	-.075**	-.073**	-.043	-.245**	.182**	.427**	.854**	-.244**	.333**	.360**	-.236**	.040	-.139**	-.228**	-.358**	.169**	.440**
54. Institutional support (T5)	.140**	.165**	.176**	.179**	.183**	.259**	.042	-.053*	-.231**	.768**	-.218**	-.135**	.104**	-.087**	.229**	.165**	.288**	-.009	-.058**
55. Dropout intentions (T5)	-.303**	-.323**	-.377**	-.391**	-.343**	-.386**	-.077**	.076**	.317**	-.233**	.761**	.252**	-.241**	.091**	-.304**	-.246**	-.499**	-.088*	.069**
56. Negative affect (T5)	-.035	-.017	.000	-.001	-.026	-.265**	.242**	.245**	.442**	-.269**	.326**	.486**	-.103	.193*	-.110	-.288**	-.171	.279**	.233**
57. Performance (T5)	.177**	.238**	.203**	.215**	.335**	.039	-.228*	-.057	-.249**	.292**	-.243**	-.246**	.328**	-.250**	.179	.215*	.165	-.169	-.053
58. Absenteeism (T5)	-.096	-.146*	-.119	-.073	-.106	.037	.061	.023	.080	-.003	.038	.129	-.179	.021	.150	-.001	.044	.046	.038
59. Program satisfaction (T5)	.302**	.186**	.279**	.276**	.315**	.426**	.207*	-.032	-.228**	.421**	-.373**	-.140	.148	-.196*	.317**	.165	.412**	.076	-.028
60. Life satisfaction (T5)	.129	.135*	.135*	.135*	.152*	.283**	-.133	-.113	-.324**	.371**	-.322**	-.405**	.206*	-.134	.175	.396**	.254**	-.123	-.126
61. Age	.222**	.272**	.270**	.272**	.256**	.036	-.012	.123**	-.001	.021	-.083**	-.187**	-.101**	.041	.043	.100**	.011	.051	.152**
62. Sex	.049*	.038	.034	.032	.038	.097**	.067*	.058*	-.005	.060**	.026	.094**	-.049	.029	.002	-.051	.079*	.001	.040
63. Repeating a year	-.097**	-.069**	-.070**	-.068**	-.089**	-.041	-.005	-.005	.084**	-.113**	.105**	.075**	.002	.193**	-.059*	-.074**	.036	.049	.002
64. Personal situation	.107**	.131**	.133**	.133**	.122**	.039	.042	.096**	.014	-.006	-.059**	-.018	.019	.010	.027	.100**	.066	.157**	.118**
65. Children	.177**	.228**	.226**	.222**	.203**	.036	.022	.097**	.003	.039*	-.059**	-.146**	-.076**	.100**	.059*	.071*	.039	.074*	.133**
66. Scholarship	-.113**	-.136**	-.131**	-.127**	-.123**	-.015	.042	-.015	.025	-.008	.064**	.108**	-.007	-.008	-.036	-.097**	-.053	-.030	-.040
67. Financial help	-.137**	-.163**	-.165**	-.152**	-.130**	-.043	-.076**	-.110**	-.014	.011	.052*	.126**	.017	.001	-.031	-.052	.009	-.144**	-.122**
68. Job	.035	.043*	.048*	.047*	.041*	.076**	.065*	.043	.009	-.101**	-.022	-.063*	.049	.034	.014	.053	.076*	.040	.028

Note. * $p < .05$; ** $p < .01$; all variables with the exception of performance, absenteeism, satisfaction toward the program, life satisfaction, age, sex (0: Male or 1: Female), repeating a year (0: No or 1: Yes), personal situation (0: Single or 1: In couple), number of children, scholarship (0: No or 1: Yes), financial help (0: No or 1: Yes), and having a job (0: No or 1: Yes) are estimated from factor scores with a mean of 0 and a standard deviation of 1.

Table S5. *Correlations between Variables (Continued 1)*

	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
20. Hindrance demands (T2)	-																		
21. Institutional support (T2)	-.285**	-																	
22. Dropout intentions (T2)	.390**	-.276**	-																
23. Negative affect (T2)	.450**	-.173**	.360**	-															
24. Performance (T2)	-.335**	.201**	-.423**	-.321**	-														
25. Absenteeism (T2)	.044	-.059	.031	.056	-.088*	-													
26. Program satisfaction (T2)	-.319**	.333**	-.428**	-.201**	.304**	-.049	-												
27. Life satisfaction (T2)	-.348**	.225**	-.304**	-.426**	.333**	-.055	.356**	-											
28. Harmonious passion (T3)	-.430**	.343**	-.502**	-.223**	.260**	.000	.263**	.307**	-										
29. Obsessive passion (T3)	.175**	-.043	-.155**	.211**	.110	-.037	.036	.027	.283**	-									
30. Challenge demands (T3)	.410**	-.030	.007	.204**	-.009	-.006	.026	-.031	-.030	.439**	-								
31. Hindrance demands (T3)	.935**	-.286**	.364**	.428**	-.312**	.068	-.286**	-.327**	-.378**	.262**	.490**	-							
32. Institutional support (T3)	-.290**	.948**	-.275**	-.193**	.172**	-.030	.340**	.213**	.365**	-.054	-.046*	-.297**	-						
33. Dropout intentions (T3)	.398**	-.294**	.909**	.322**	-.393**	.067	-.398**	-.305**	-.577**	-.151**	.042	.402**	-.324**	-					
34. Negative affect (T3)	.458**	-.268**	.337**	.723**	-.335**	.068	-.242**	-.342**	-.252**	.228**	.284**	.474**	-.284**	.375**	-				
35. Performance (T3)	-.377**	.240**	-.437**	-.385**	.646**	-.167**	.233**	.356**	.386**	.137**	.015	-.346**	.240**	-.445**	-.374**	-			
36. Absenteeism (T3)	.113*	-.003	.032	.144*	-.183**	.793**	.006	-.164*	-.077	-.094*	.019	.130**	.033	.133**	.110*	-.211**	-		
37. Program satisfaction (T3)	-.367**	.382**	-.466**	-.235**	.296**	.012	.527**	.254**	.466**	.152**	.003	-.343**	.401**	-.515**	-.245**	.342**	-.028	-	
38. Life satisfaction (T3)	-.343**	.283**	-.352**	-.437**	.381**	-.151*	.243**	.561**	.333**	.015	-.050	-.332**	.278**	-.402**	-.398**	.364**	-.191**	.349**	-
39. Harmonious passion (T4)	-.363**	.371**	-.453**	-.248**	.191*	.241**	.293**	.301**	.667**	.190*	.060	-.282**	.392**	-.506**	-.238**	.244**	.121	.419**	.319**
40. Obsessive passion (T4)	.265**	-.040	-.037	.359**	-.059	.190*	.018	-.050	.153	.763**	.448**	.301**	-.057	-.027	.301**	.032	.123	.208*	-.013
41. Challenge demands (T4)	.414**	-.011	-.006	.186**	.007	-.033	.040	-.010	-.017	.418**	.944**	.404**	-.025	.011	.223**	.063	-.022	.034	.007
42. Hindrance demands (T4)	.961**	-.282**	.374**	.443**	-.326**	.083*	-.315**	-.341**	-.380**	.243**	.474**	.958**	-.290**	.385**	.483**	-.346**	.146**	-.329**	-.325**
43. Institutional support (T4)	-.288**	.950**	-.273**	-.194**	.177**	-.039	.340**	.222**	.360**	-.044	-.044	-.290**	.993**	-.319**	-.275**	.239**	.020	.391**	.273**
44. Dropout intentions (T4)	.396**	-.293**	.904**	.320**	-.378**	.045	-.395**	-.295**	-.518**	-.094*	.047*	.389**	-.317**	.936**	.358**	-.427**	.106*	-.483**	-.387**
45. Negative affect (T4)	.498**	-.266**	.309**	.730**	-.294**	-.079	-.173*	-.257**	-.230**	.371**	.375**	.486**	-.276**	.327**	.790**	-.349**	-.105	-.251**	-.322**
46. Performance (T4)	-.386**	.350**	-.390**	-.318**	.563**	.003	.206*	.140	.311**	-.047	-.082	-.303**	.339**	-.365**	-.337**	.586**	-.008	.328**	.394**
47. Absenteeism (T4)	.052	-.068	.058	.016	-.032	.405**	.061	.099	.017	.054	-.095	-.003	-.037	.080	.015	.001	.510**	.124	.073
48. Program satisfaction (T4)	-.355**	.461**	-.485**	-.233**	.240**	.077	.454**	.224*	.525**	.106	.092	-.255**	.462**	-.504**	-.261**	.386**	-.037	.577**	.294**
49. Life satisfaction (T4)	-.365**	.263**	-.274**	-.402**	.331**	-.056	.271**	.436**	.265**	-.088	-.155*	-.337**	.267**	-.272**	-.337**	.435**	-.110	.331**	.691**
50. Harmonious passion (T5)	-.366**	.446**	-.458**	-.140	.066	.145	.256**	.183	.677**	.177	.048	-.287**	.450**	-.516**	-.205*	.292**	.021	.376**	.203*
51. Obsessive passion (T5)	.291**	.054	-.027	.334**	-.080	.147	-.019	-.053	.184	.767**	.502**	.349**	.050	-.018	.304**	.073	.084	.142	-.159
52. Challenge demands (T5)	.424**	-.023	.014	.220**	-.028	-.021	.013	-.042	-.043	.431**	.963**	.433**	-.037	.038	.280**	.019	.001	.005	-.033
53. Hindrance demands (T5)	.944**	-.290**	.380**	.433**	-.334**	.088*	-.314**	-.342**	-.393**	.222**	.447**	.969**	-.298**	.405**	.491**	-.363**	.153**	-.366**	-.335**
54. Institutional support (T5)	-.287**	.948**	-.272**	-.191**	.166**	-.039	.333**	.218**	.362**	-.046	-.045*	-.287**	.984**	-.320**	-.276**	.230**	.012	.386**	.277**
55. Dropout intentions (T5)	.392**	-.299**	.871**	.313**	-.385**	.059	-.384**	-.279**	-.538**	-.086	.052*	.393**	-.330**	.954**	.371**	-.412**	.130**	-.490**	-.394**
56. Negative affect (T5)	.470**	-.269**	.357**	.742**	-.160	-.121	-.183*	-.413**	-.250**	.300**	.281**	.482**	-.272**	.388**	.754**	-.244**	-.048	-.128	-.383**
57. Performance (T5)	-.295**	.354**	-.291**	-.328**	.520**	-.017	.115	.104	.283**	-.084	-.034	-.248**	.322**	-.321**	-.291**	.444**	-.089	.101	.180
58. Absenteeism (T5)	.035	-.016	.050	.279**	-.262**	.206*	.022	-.015	.129	.151	-.003	.023	-.005	.043	.143	-.062	.579**	.032	-.165
59. Program satisfaction (T5)	-.274**	.465**	-.422**	-.250**	.273**	-.042	.292**	.028	.460**	.029	-.020	-.238**	.464**	-.451**	-.258**	.365**	-.095	.466**	.171
60. Life satisfaction (T5)	-.334**	.356**	-.346**	-.490**	.217*	.018	.197*	.389**	.274**	-.168	-.144*	-.345**	.354**	-.373**	-.471**	.368**	-.041	.270**	.495**
61. Age	-.001	.017	-.084**	-.191**	.008	-.079*	.076*	.101**	-.030	.100*	.150**	.004	.024	-.068**	-.163**	.121**	-.110*	.096*	.163**
62. Sex	-.016	.051**	.015	.138**	.012	.006	.064	-.001	.061	.046	.059**	-.015	.038	.010	.124**	-.063	.001	-.038	-.087
63. Repeating a year	.061**	-.095**	.092**	.035	-.027	.214**	-.011	-.113**	-.059	-.053	-.015	.073**	-.087**	.104**	.020	-.106*	.095*	-.083	-.131**
64. Personal situation	.028	-.017	-.054*	-.006	.047	-.063	.087*	.123**	.012	.152**	.100**	.019	-.015	-.049*	-.001	.096*	-.085	.015	.155**
65. Children	.006	.044*	-.053*	-.176**	.039	-.085*	.107**	.089*	-.048	.096*	.128**	.012	.048*	-.039	-.121**	.107*	-.084	.079	.188**
66. Scholarship	.018	-.001	.068**	.102**	-.015	.087*	-.069	-.100**	.003	-.050	-.049*	.012	.001	.068**	.084	-.007	.002	-.068	-.116*
67. Financial help	-.023	.016	.052*	.063	.012	.015	-.031	-.053	.044	-.115*	-.115**	-.015	.015	.047*	.135**	-.041	.142**	-.075	-.078
68. Job	.007	-.087**	-.031	-.064	.059	.046	-.027	-.033	-.022	.031	.037	.006	-.080**	-.031	.016	-.015	-.038	.001	-.030

Note. * $p < .05$; ** $p < .01$; all variables with the exception of performance, absenteeism, satisfaction toward the program, life satisfaction, age, sex (0: Male or 1: Female), repeating a year (0: No or 1: Yes), personal situation (0: Single or 1: In couple), number of children, scholarship (0: No or 1: Yes), financial help (0: No or 1: Yes), and having a job (0: No or 1: Yes) are estimated from factor scores with a mean of 0 and a standard deviation of 1.

Table S5. *Correlations between Variables (Continued 2)*

	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57
39. Harmonious passion (T4)	-																		
40. Obsessive passion (T4)	.234**	-																	
41. Challenge demands (T4)	.054	.471**	-																
42. Hindrance demands (T4)	-.287**	.332**	.431**	-															
43. Institutional support (T4)	.400**	-.042	-.026	-.287**	-														
44. Dropout intentions (T4)	-.549**	.020	.021	.388**	-.317**	-													
45. Negative affect (T4)	-.214**	.355**	.364**	.500**	-.272**	.345**	-												
46. Performance (T4)	.349**	-.056	-.085	-.358**	.345**	-.430**	-.400**	-											
47. Absenteeism (T4)	-.042	.190**	-.058	.059	-.065	.080	.051	-.076	-										
48. Program satisfaction (T4)	.554**	.225**	.071	-.277**	.472**	-.528**	-.153*	.331**	-.002	-									
49. Life satisfaction (T4)	.320**	-.048	-.154*	-.391**	.276**	-.304**	-.388**	.404**	-.057	.356**	-								
50. Harmonious passion (T5)	.732**	.207	.000	-.305**	.458**	-.505**	-.195	.380**	.084	.615**	.316**	-							
51. Obsessive passion (T5)	.221*	.768**	.502**	.333**	.046	-.002	.335**	.072	.086	.151	-.125	.305**	-						
52. Challenge demands (T5)	.028	.451**	.971**	.448**	-.038	.048*	.398**	-.084	-.095	.049	-.151*	-.001	.522**	-					
53. Hindrance demands (T5)	-.284**	.308**	.382**	.981**	-.295**	.399**	.494**	-.298**	.043	-.261**	-.353**	-.290**	.336**	.427**	-				
54. Institutional support (T5)	.403**	-.037	-.028	-.285**	.995**	-.320**	-.269**	.338**	-.060	.482**	.277**	.479**	.053	-.041	-.295**	-			
55. Dropout intentions (T5)	-.532**	.008	.029	.384**	-.330**	.952**	.354**	-.410**	.085	-.545**	-.323**	-.526**	.022	.057*	.405**	-.339**	-		
56. Negative affect (T5)	-.269**	.239*	.269**	.481**	-.284**	.380**	.711**	-.274**	-.092	-.228*	-.434**	-.294**	.187**	.319**	.491**	-.301**	.435**	-	
57. Performance (T5)	.209*	-.135	-.057	-.254**	.335**	-.350**	-.314**	.588**	-.165	.289**	.224*	.364**	.024	-.085	-.265**	.350**	-.441**	-.378**	-
58. Absenteeism (T5)	.004	.212*	-.007	.026	-.006	.044	.057	-.041	.366**	.025	-.352**	.024	.022	-.023	-.002	.013	.049	.168**	-.214**
59. Program satisfaction (T5)	.428**	.130	-.056	-.256**	.481**	-.457**	-.204	.477**	-.026	.736**	.280**	.587**	.205**	-.050	-.247**	.491**	-.467**	-.181**	.381**
60. Life satisfaction (T5)	.269*	-.080	-.150*	-.330**	.344**	-.391**	-.358**	.310**	-.055	.210	.659**	.404**	-.024	-.164*	-.337**	.360**	-.413**	-.465**	.372**
61. Age	.050	.055	.153**	-.005	.023	-.066**	-.207**	.067	-.045	.042	.136*	.021	.030	.149**	-.011	.023	-.065**	-.230**	.167*
62. Sex	.067	-.113	.059**	-.010	.037	.009	.098	-.082	.050	-.035	-.081	.043	.072	.065**	-.013	.038	.007	.124*	-.067
63. Repeating a year	-.017	-.072	-.017	.055*	-.084**	.108**	-.021	-.071	-.018	-.059	-.014	-.240**	-.034	-.022	.058**	-.087**	.117**	.164**	-.162*
64. Personal situation	.022	.024	.107**	.012	-.017	-.053*	-.052	.074	-.035	.061	.277**	.001	.045	.109**	.012	-.020	-.044*	-.035	-.070
65. Children	.096	.045	.136**	.004	.050*	-.044*	-.141*	.081	.001	.076	.132	.050	.055	.125**	.000	.051**	-.041	-.163**	.179**
66. Scholarship	.026	-.030	-.039	.019	.000	.055*	.049	-.084	.088	-.069	-.064	-.028	.005	-.041	.022	-.001	.065**	.213**	-.078
67. Financial help	-.020	-.063	-.123**	-.018	.016	.042	.106	.081	-.033	-.078	-.025	-.036	-.064	-.120**	-.008	.017	.046*	.219**	-.086
68. Job	.043	-.011	.034	.008	-.078**	-.036	-.144*	.035	-.073	.041	.098	.017	.021	.042	.005	-.080**	-.032	-.005	.046

Note. * $p < .05$; ** $p < .01$; all variables with the exception of performance, absenteeism, satisfaction toward the program, life satisfaction, age, sex (0: Male or 1: Female), repeating a year (0: No or 1: Yes), personal situation (0: Single or 1: In couple), number of children, scholarship (0: No or 1: Yes), financial help (0: No or 1: Yes), and having a job (0: No or 1: Yes) are estimated from factor scores with a mean of 0 and a standard deviation of 1.

Table S5. *Correlations between Variables (Continued 3)*

	58	59	60	61	62	63	64	65	66	67	68
58. Absenteeism (T5)	-										
59. Program satisfaction (T5)	.074	-									
60. Life satisfaction (T5)	-.070	.368**	-								
61. Age	-.053	.024	.126	-							
62. Sex	-.076	-.056	-.006	-.083**	-						
63. Repeating a year	.032	-.137*	-.269**	-.037	-.017	-					
64. Personal situation	-.076	.069	.173**	.270**	.005	-.003	-				
65. Children	-.052	.080	.199**	.767**	-.039*	-.045*	.249**	-			
66. Scholarship	-.025	-.061	-.052	-.337**	.036	.075**	-.131**	-.240**	-		
67. Financial help	.084	-.053	-.035	-.471**	.044*	-.011	-.186**	-.359**	.067**	-	
68. Job	-.063	.094	-.002	.065**	-.028	.120**	.060**	.035	-.011	-.081**	-

Note. * $p < .05$; ** $p < .01$; all variables with the exception of performance, absenteeism, satisfaction toward the program, life satisfaction, age, sex (0: Male or 1: Female), repeating a year (0: No or 1: Yes), personal situation (0: Single or 1: In couple), number of children, scholarship (0: No or 1: Yes), financial help (0: No or 1: Yes), and having a job (0: No or 1: Yes) are estimated from factor scores with a mean of 0 and a standard deviation of 1.

Table S6

Model Fit Statistics for the Preliminary Latent Curve Models

Description	χ^2 (*df*)	CFI	TLI	RMSEA	90% CI
Challenge Demands (Predictor)					
Linear	957.182 (10)*	.780	.780	.219	[.208; .231]
Quadratic	879.031 (6)*	.797	.662	.272	[.257; .287]
Latent basis	260.552 (7)*	.941	.916	.136	[.122; .150]
Latent basis modified	271.016 (9)*	.939	.932	.122	[.109; .134]
Hindrance Demands (Predictor)					
Linear	993.433 (10)*	.756	.756	.223	[.212; .235]
Quadratic	368.529 (6)*	.910	.850	.175	[.160; .191]
Latent basis	182.806 (7)*	.956	.938	.113	[.099; .127]
Latent basis modified	205.428 (9)*	.951	.946	.105	[.093; .118]
Institutional Support (Predictor)					
Linear	1306.387 (10)*	.735	.735	.223	[.213; .233]
Quadratic	467.534 (6)*	.906	.843	.172	[.159; .185]
Latent basis	370.889 (7)*	.926	.894	.141	[.129; .153]
Latent basis modified	419.656 (9)*	.916	.907	.132	[.121; .143]
Harmonious Passion (Predictor)					
Linear	18.519 (10)*	.974	.974	.021	[.002; .035]
Quadratic	14.952 (6)*	.973	.955	.027	[.010; .045]
Latent Basis	12.548 (7)	.983	.976	.020	[.000; .037]
Obsessive Passion (Outcome)					
Linear	10.443 (10)	.999	.999	.005	[.000; .025]
Quadratic	6.559 (6)	.998	.997	.007	[.000; .030]
Latent Basis	8.166 (7)	.997	.995	.009	[.000; .030]
Dropout Intentions (Outcome)					
Linear	205.541 (10)*	.889	.889	.098	[.086; .110]
Quadratic	203.899 (6)*	.888	.813	.127	[.112; .142]
Latent Basis	61.365 (7)*	.969	.956	.062	[.048; .076]
Negative Affect (Outcome)					
Linear	15.941 (10)	.988	.988	.016	[.000; .031]
Quadratic	5.772 (6)	1.000	1.000	.000	[.000; .027]
Latent Basis	12.898 (7)	.988	.983	.019	[.000 .036]
Life Satisfaction (Outcome)					
Linear	17.269 (10)	.968	.968	.020	[.000; .035]
Quadratic	10.903 (6)	.979	.964	.021	[.000; .040]
Latent basis	15.735 (7)*	.962	.946	.026	[.008; .043]
Program Satisfaction (Outcome)					
Linear	18.109 (10)	.933	.933	.021	[.000; .036]
Quadratic	4.732 (6)	1.000	1.000	.000	[.000; .026]
Latent basis	20.298 (7)*	.890	.843	.032	[.016; .048]
Performance (Outcome)					
Linear	15.560 (10)	.980	.980	.017	[.000; .033]
Quadratic	3.004 (6)	1.000	1.000	.000	[.000; .019]
Latent basis	4.486 (7)	1.000	1.000	.000	[.000; .021]
Absenteeism (Outcome)					
Linear	272.005 (10)*	.000	.000	.113	[.102; .125]
Quadratic	98.533 (6)*	.642	.403	.087	[.072; .102]
Latent basis	25.340 (7)*	.929	.899	.036	[.021; .051]

Note. * $p < .05$; χ^2: Robust chi-square test of exact fit; *df*: Degrees of freedom; CFI: Comparative fit index; TLI: Tucker-Lewis index; RMSEA: Root mean square error of approximation; 90% CI: 90% confidence interval.

Table S7

Parameter Estimates for the Final Latent Curve Models for the Predictors

Parameter	Challenge Demands Estimate (*t*)	Hindrance Demands Estimate (*t*)	Harmonious Passion Estimate (*t*)	Obsessive Passion Estimate (*t*)	Institutional Support Estimate (*t*)
Intercept mean	.019 (1.369)	.002 (.085)	.075 (3.496)**	.001 (.035)	.045 (2.958)**
Linear Slope mean	.004 (1.329)	.453 (50.319)**	-.078 (-6.392)**	.004 (.309)	-.138 (-12.828)**
Quadratic Slope Mean	NA	NA	NA	NA	NA
Intercept variability (SD = √σ)	.877 (10.986)**	.715 (30.314)**	.692 (10.615)**	.724 (13.297)**	.778 (27.451)**
Linear Slope variability (SD = √σ)	.032 (.000)**	.134 (3.108)**	.152 (1.896)	.164 (2.478)*	.549 (20.266)**
Quadratic Slope Variability (SD = √σ)	NA	NA	NA	NA	NA
Intercept-Linear Slope Correlation	7.251 (22.351)**	-.326 (-5.836)**	-.134 (-.769)	-.246 (-2.002)*	-.238 (-8.271)**
Intercept-Quadratic Slope Correlation	NA	NA	NA	NA	NA
Linear-Quadratic Slope Correlation	NA	NA	NA	NA	NA
Time Score (λ)_T1	0 (fixed)	0 (fixed)	0 (fixed)	0 (fixed)	0 (fixed)
Time Score (λ)_T2	.681 (32.468)**	.352 (23.410)**	1 (fixed)	1 (fixed)	.654 (49.083)**
Time Score (λ)_T3	0 (fixed)	1 (fixed)	2 (fixed)	2 (fixed)	1 (fixed)
Time Score (λ)_T4	.681 (32.468)**	1 (fixed)	3 (fixed)	3 (fixed)	1 (fixed)
Time Score (λ)_T5	1 (fixed)	1 (fixed)	4 (fixed)	4 (fixed)	1 (fixed)
SD(εyi)_T1	.351 (18.786)**	.375 (15.044)**	.553 (6.787)**	.502 (6.636)**	.032 (.000)**
SD(εyi)_T2	.241 (12.533)**	.182 (9.780)**	.517 (8.378)**	.480 (7.432)**	.205 (15.685)**
SD(εyi)_T3	.210 (14.220)**	.161 (12.147)**	.588 (7.338)**	.507 (6.849)**	.105 (12.552)**
SD(εyi)_T4	.089 (4.408)**	.095 (6.464)**	.458 (4.874)**	.444 (4.867)**	.032 (.000)**
SD(εyi)_T5	.138 (7.994)**	.095 (6.985)**	.549 (3.242)**	.373 (2.121)*	.084 (8.886)**

Note. t = Estimate / standard error of the estimate (t values are computed from the original variance estimate and not from the square root); SD(εyi) = Standard deviation of the time-specific residual; the square root of the estimate of variability (trajectory factor and time-specific residual) is presented so that the results can be interpreted in the same unit as the construct used in the model (here, factor scores are interpreted in natural units); * $p \leq .05$; ** $p \leq .01$.

Table S8

Parameter Estimates for the Final Latent Curve Models for the Outcomes

Parameter	Dropout Intentions Estimate (*t*)	Negative Affect Estimate (*t*)	Performance Estimate (*t*)	Absenteeism Estimate (*t*)	Life Satisfaction Estimate (*t*)	Program Satisfaction Estimate (*t*)
Intercept mean	-.017 (-.922)	-.022 (-1.131)	7.229 (182.074)**	1.144 (29.667)**	3.051 (162.654)**	3.320 (201.969)**
Linear Slope mean	.059 (5.294)**	.025 (2.532)*	-.045 (-1.843)	.170 (3.681)**	-.041 (-1.496)	-.081 (-3.282)**
Quadratic Slope Mean	NA	NA	NA	NA	-.001 (-.130)	.010 (1.469)
Intercept variability (SD = √σ)	.793 (22.615)**	.670 (11.671)**	1.104 (7.119)**	.410 (1.453)	.578 (4.696)**	.444 (3.106)**
Linear Slope variability (SD = √σ)	.401 (9.532)**	.095 (1.868)	.286 (2.412)*	.566 (1.224)	.405 (2.097)*	.404 (2.559)*
Quadratic Slope Variability (SD = √σ)	NA	NA	NA	NA	.089 (2.008)*	.095 (2.855)**
Intercept-Linear Slope Correlation	-.552 (-18.383)**	.212 (.847)	-.014 (-.067)	.045 (.233)	-.336 (-1.633)	-.456 (-2.326)*
Intercept-Quadratic Slope Correlation	NA	NA	NA	NA	.248 (1.080)	.363 (1.830)
Linear-Quadratic Slope Correlation	NA	NA	NA	NA	-.930 (-23.531)**	-.925 (-31.616)**
Time Score (λ)_T1	0 (fixed)	0 (fixed)	0 (fixed)	0 (fixed)	0 (fixed)	0 (fixed)
Time Score (λ)_T2	.076 (1.533)	1 (fixed)	1 (fixed)	1 (fixed)	1 (fixed)	1 (fixed)
Time Score (λ)_T3	.698 (19.843)**	2 (fixed)	2 (fixed)	2 (fixed)	2 (fixed)	2 (fixed)
Time Score (λ)_T4	.750 (23.229)**	3 (fixed)	3 (fixed)	3 (fixed)	3 (fixed)	3 (fixed)
Time Score (λ)_T5	1.000 (fixed)	4 (fixed)	4 (fixed)	4 (fixed)	4 (fixed)	4 (fixed)
SD(εyi)_T1	.363 (9.159)**	.567 (7.971)**	1.154 (7.335)**	1.427 (1.965)*	.392 (2.247)*	.410 (2.688)**
SD(εyi)_T2	.105 (1.701)	.464 (9.052)**	.966 (8.823)**	.625 (3.036)**	.469 (6.309)**	.438 (5.339)**
SD(εyi)_T3	.192 (9.060)**	.442 (7.703)**	1.165 (7.650)**	1.112 (1.812)	.425 (4.742)**	.404 (4.121)**
SD(εyi)_T4	.176 (6.414)**	.468 (5.333)**	.962 (4.144)**	.555 (.676)	.389 (5.057)**	.344 (4.155)**
SD(εyi)_T5	.100 (.000)**	.446 (4.041)**	.969 (3.684)**	2.620 (1.122)	.333 (1.388)	.032 (.000)**

Note. t = Estimate / standard error of the estimate (t values are computed from the original variance estimate and not from the square root); SD(εyi) = Standard deviation of the time-specific residual; the square root of the estimate of variability (trajectory factor and time-specific residual) is presented so that the results can be interpreted in the same unit as the construct used in the model (here, factor scores are interpreted in natural units); * $p \leq .05$; ** $p \leq .01$.

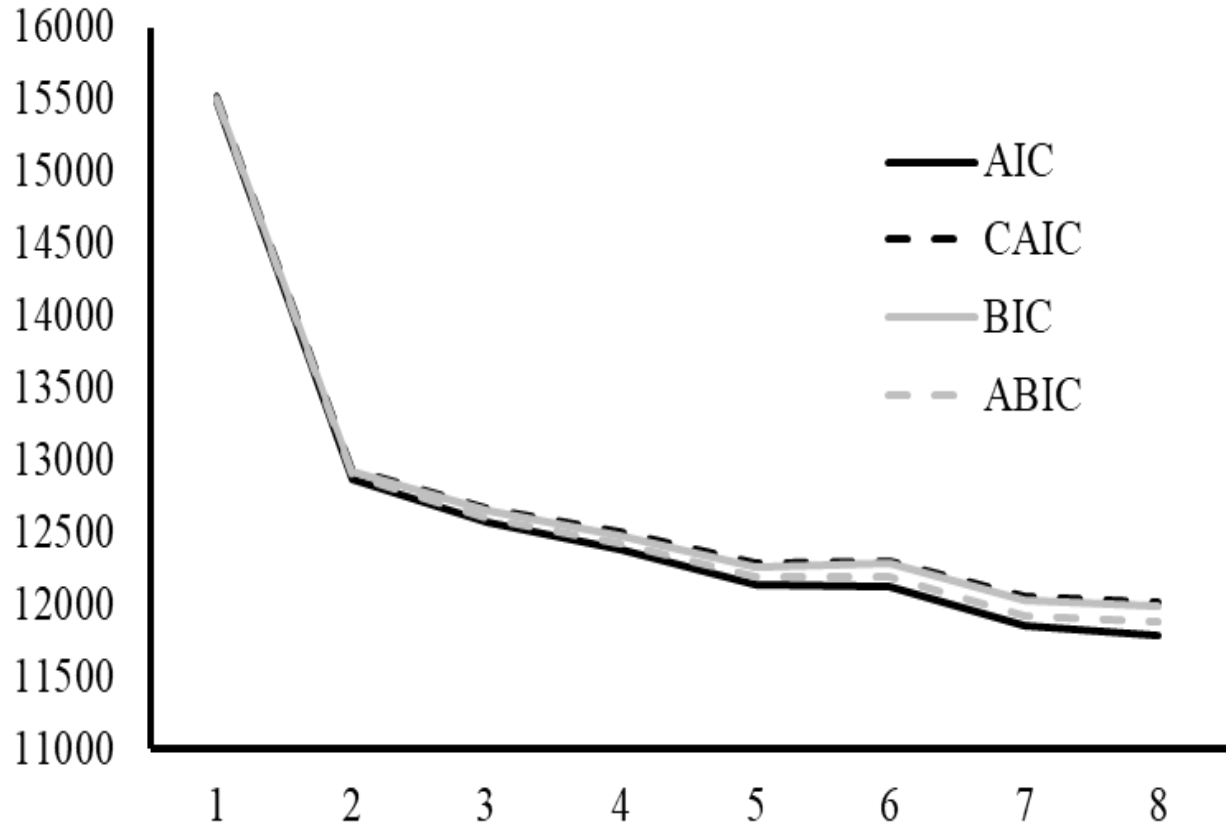

Figure S1

Elbow Plot Associated with the Profiles of Global Engagement Trajectories

Table S9

Classification Accuracy: Average Probability of Membership into Each Latent Profile (Column) as a Function of the Most Likely Profile Membership (Row)

	Profile 1	Profile 2	Profile 3	Profile 4
Profile 1	.861	.116	.023	.000
Profile 2	.024	.912	.035	.029
Profile 3	.008	.098	.893	.000
Profile 4	.001	.231	.003	.765

Note. The profile indicators are estimated from factor scores with a mean of 0 and a standard deviation of 1; Profile 1: High and Stable; Profile 2: Moderate and Decreasing; Profile 3: Low and Decreasing; and Profile 4: Low and Stable.