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Identifying higher education students' profiles of academic engagement and burnout and analysing their predictors and outcomes

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Abstract
A review of research on the relationship between academic engagement and burnout reveals three research gaps as most of the research was conducted: i) without analysing all its multiple dimensions; ii) from a variable-centred perspective; and iii) in educational contexts other than higher education. We seek to address these gaps and thus enhance our understanding of the nature of the mentioned relationship. Adopting a person-centred perspective, a latent profile analysis (LPA) was used to identify how all the dimensions of academic engagement and burnout combine in different profiles of higher education students (n=430). Additional analyses were used to validate these LPA profiles by relating them to a set of auxiliary variables (i.e., predictors and outcomes), grounded on theoretical models relevant to higher education. LPA revealed three ordered profiles (burned-out, moderately engaged and engaged) and the additional analyses detected statistically significant associations between predictors (e.g., perceptions of academic quality, perceptions of stress) and profile membership; and between these and outcomes. The latter tended to be ordered from the least to the most desirable in learning strategies (e.g., self-regulation, deep processing) and learning outcomes (e.g., generic skills, satisfaction), with the most desirable generally being associated more with the two engaged profiles than with the burned-out profile.
Taken together, the findings i) expand our understanding of the nature of academic engagement and burnout in higher education, suggesting that they are related but independent constructs at different levels (high/low and weaker levels), and ii) hold implications for theory, methodology and educational practice (adjusted to the distinctiveness of the detected profiles).

Keywords Burnout · Engagement · Higher education · Latent profile analysis (LPA)

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Academic engagement is an essential construct in educational psychology (Sinatra et al., 2015), an important aspect of student experience (Shah & Richardson, 2016), which contributes to learning and academic performance (Fredricks et al., 2016), and the advancement of which is crucial for improving quality assurance in higher education (Shah & Richardson, 2016). In addition, academic engagement has been related to a multitude of variables. Thus, students who are self-efficacious, motivated, use deep learning strategies and have positive perceptions of teaching, are more likely to be engaged (Alrashidi et al., 2016; Fredricks et al., 2016; Guo et al., 2023). Several of these constructs (e.g., learning, motivation, teaching) emerge as the core of research in the content analyses of the top-ranked journals of this discipline (Nolen, 2009), which accords with Shim's (2019) claim that the way people learn and engage is an essential quest in educational psychology.

The growing emphasis on academic engagement in learning seems to be a first favourable result of the current dominance of competency and outcome-based models in higher education (Gover et al., 2019). However, its second and unfavourable result is an increase in students' perceptions of academic stressors (e.g., heavy workload), especially in the first years, perceptions that are linked to academic burnout (Bresó et al., 2007; Gusy et al., 2021) and its associated consequences (e.g., low engagement) (Asikainen et al., 2020; Schaufeli, Martínez, et al., 2002).

Previous studies on the relationship between academic engagement and burnout reveal three research gaps. Firstly, most research was undertaken in educational contexts other than higher education, as noted by Salmela-Aro and Read (2017) and Tuominen-Soini and Salmela-Aro (2014). Secondly, most research has followed a mainly variable-centred approach, generally associated with some possible weaknesses, e.g., the following two debatable assumptions: first the homogeneity of variance between the participants and the populations, when evidence exists that academic engagement is a multifaceted concept, not a stable trait of the student but rather malleable and related to the context (Fredricks et al., 2016) and second that similar results are obtained by analysing single dimensions of burnout (and of engagement) by analysing their multiple dimensions (Leiter & Maslach, 2016). Thirdly, most research was conducted without analysing all these multiple dimensions. In this vein, Leiter and Maslach (2016, 2017) stressed the importance of understanding the nature of the relationships between engagement and burnout by conducting latent profile analyses (LPAs) including all their dimensions and designating a variety of possible psychological links with work captured by these profiles. These claims still seem to be unanswered in the academic setting of higher education.

Accordingly, adopting a person-centred perspective, this research had two aims. First of all, to identify through LPAs these university students' profiles (i.e., patterns or configurations) of academic engagement and burnout (indicator variables). Secondly, to validate the resulting profiles by documenting their relations with other important, but external variables (i.e., covariates) related to psychology and education, such as antecedents or predictors (e.g., perceptions of the learning environment) and outcomes or consequents (e,g., learning strategies). Basically, this study contributes to research on the engagement-burnout relationship by firstly identifying the most naturally occurring profiles of this relationship, and secondly, documenting their practical value regarding their links with key external variables. These variables are linked to recent theoretical models relevant to higher education and provide a better understanding of inter-individual heterogeneity in order to design tailored interventions, thus contributing to both educational practice and psychological theory, and thereby, to educational psychology. Mayer (2018) defined it as a science between psychology and education, Ausubel (2012) as an applied science, and O'Donnell and Levin

(2001) as "the development and application of psychological principles to education, as well as the adoption of psychological perspectives on education" (p. 73).

Theoretical perspectives

Research on burnout and engagement has received substantial research attention in Europe, America and Australia since their origins in human services and business, respectively, in the last quarter century (Leiter & Maslach, 2017; Schaufeli & De Witte, 2017). This has led to a plethora of definitions and theoretical perspectives (Alrashidi et al., 2016; Schaufeli et al., 2009; Schaufeli, Salanova, et al., 2002), of which Schaufeli, Salanova, et al. (2002) and Maslach and Leiter (1997) are the most relevant in the context of the current study. Subsequently, both constructs were extended beyond their origins to include diverse occupations, e.g., studying (Lesener et al., 2020), as academic activities are structured, compulsory and goal-directed, so they could be considered 'work' in psychological terms, as noted by Lesener et al. (2020) after analysing the data of over 5,000 students from various German universities.

Research on burnout has its roots in the mid-1970s with Freudenberger (1974) coining this term and the work of Maslach and collaborators (e.g., Leiter & Maslach, 2016; Maslach et al., 2001) i) conceptualising burnout as a negative state of mind that emerges in response to excessive and prolonged emotional and interpersonal stressors at work and ii) designing the Maslach Burnout Inventory (MBI) (Maslach & Jackson, 1981) to measure it. Research on engagement, which began with Kahn's (1990) view that engagement is the result of a personal decision, set a milestone in Maslach et al.'s (2001) findings linking job burnout and engagement as opposite poles of a continuum. Since then, Schaufeli, Martínez, et al. (2002) and Schaufeli, Salanova, et al. (2002) proposed an alternative perspective and measure of engagement.

Schaufeli, a Dutch psychologist, and his collaborators defined academic burnout as a three-dimensional psychological syndrome characterised by emotional exhaustion (i.e., feeling overwhelmed and lacking emotional resources), cynicism (i.e., a distant and sceptical attitude), and academic inefficacy (i.e., a feeling of incompetence as a student) (Schaufeli, Salanova, et al., 2002). They designed an adaptation of the MBI for use with university students, the MBI Student Survey (MBI-SS), whose psychometric properties were improved later by including an inefficacy scale in lieu of the traditional efficacy measure (Bresó et al., 2007; Simbula & Guglielmi, 2010). This measure, unlike Maslach's MBI, was focused exclusively on burnout.

Schaufeli, Martínez, et al. (2002) defined engagement as "a positive, fulfilling, work-related state of mind that is characterised by vigour, dedication, and absorption" (p. 74) that, therefore, must be measured independently of burnout using an alternative scale. This led them to create the Utrecht Work Engagement Scale (UWES) and develop the UWES-S (Schaufeli, Salanova, et al., 2002), a version adapted for university students. In this vein, academic engagement involves "a high level of energy and mental resilience when studying (vigour), deriving a sense of significance, enthusiasm and inspiration from study (dedication), and being fully concentrated and happily engrossed in one's study (absorption)" (Zhang et al., 2007, p. 1530).

Based on these engagement-burnout links, Bakker and Demerouti (2007) elaborated the job demands-resources (JD-R) model, which Lesener et al. (2020) translated and validated for the university context as the study demands-resources (SD-R) model. They proposed

that i) studying involves demands (e.g., perceived workload) and resources (e.g., autonomy, teacher support) and that ii) high study demands are linked (positively) to student burnout and result in negative outcomes, whereas high study resources diminish students' burnout while increasing their engagement, leading to positive outcomes.

The engagement-burnout relationship

This relationship has, since 2002, been a challenging topic of ongoing debate between proponents of contrasting perspectives on burnout and engagement. The basic question is whether they are opposite poles of a single dimension (Maslach & Leiter, 1997) or are correlated but independent (Schaufeli, Salanova, et al., 2002)? Alternatively, as Schaufeli and De Witte (2017) have suggested, could they be a dual entity (neither completely opposite nor completely independent)? Leiter and Maslach (2016) proposed using a latent profile analysis including the subscales of both the MBI and the UWES. Furthermore, Schaufeli and De Witte (2017, p. 1) observed that "the debate is decisively influenced by the way both concepts are operationalised... and... psychometric studies can only be carried out under the condition of independence". A statement corroborated by Trépanier et al. (2015), who called into question the use of the same test to measure both work engagement and burnout. Hence, Schaufeli, Salanova, et al.'s (2002) perspective and measures would seem the most suitable choice for the current study.

Research on the engagement-burnout relationship

Much of this research has focused on variable-centred analyses, e.g., structural equation modelling (Hakanen et al., 2006), in which "average" parameters for the relations among variables are yielded for all participants (Salmela-Aro et al., 2016). In contrast, to date, only a handful of studies have focused on person-centred analyses, and very few of them have used higher education students as participants or taken into account theoretical models relevant for academic settings such as the SD-R (Lesener et al., 2020). These analyses are better suited to examining the combinations of variables within specific individuals and then validating them (Gillet et al., 2020; Salmela-Aro et al., 2016).

Most of these person-centred studies share four characteristics. First, they are authored by Finnish psychologists. Second, they focus on LPAs, tending to include three indicators of burnout (from a measure based on the MBI) and one of engagement (an overall score derived from a short version of the UWES). Third, they apparently lack model specifications (i.e., the within-class variance-covariance structure), which might suggest that the default method in Mplus (means freely estimated and variances constrained to be equal) was used. Lastly, they identify two to four profiles of engagement-burnout within the educational context.

Salmela-Aro et al. (2019) found two profiles, engaged and engaged-burnout, that showed differences in teachers' perceived job resources and demands (higher in the engaged and the engaged-burned-out, respectively). For higher education students, Salmela-Aro and Read (2017) identified four profiles: engaged (high engagement and low burnout), engaged-exhausted (exhaustion and engagement); inefficacious (around the mean in all the scales) and burned-out (low engagement and high cynicism and inadequacy). In line with the J-DR model, those with the two latter profiles perceived higher demands (e.g., internet dependency) and lower resources (e.g., can talk with someone) than those with the two former.

Salmela-Aro et al. (2016) also found support for a four-profile model in higher education students: i) engaged (high engagement, low burnout levels); ii) burned-out (low engagement, high burnout levels); iii) engaged-exhausted (moderate scores on both engagement and burnout); and iv) moderately burned-out (moderate scores on burnout and low scores on engagement).

These students' experiences of simultaneously combining moderate levels of burnout and engagement were one of the key conclusions from the research, as they indicated that these students were at risk of suffering burnout (Salmela-Aro et al., 2016). The findings resembled those previously reported by Tuominen-Soini and Salmela-Aro (2014) (engaged; engaged-exhausted; cynical and burned-out), with 'cynical' being equivalent to moderately burned-out. Moreover, similar to Salmela-Aro and Read's (2017) findings, the four groups perceived different demands and resources in their academic environment related to their burnout and engagement, respectively.

Following the identification of academic engagement-burnout profiles, it is essential to validate them by demonstrating that they are meaningfully related to a wide variety of possible psychological covariates (i.e., predictors and outcomes) (Gillet et al., 2020; Leiter & Maslach, 2016, 2017). However, beforehand it seems appropriate to offer an overview about some essential concepts concerning the learning process in higher education so as to facilitate a better understanding of many of the covariates used in the present study.

How students learn in higher education

Three conceptual frameworks have been widely used in Europe by educational psychology researchers investigating the learning process in higher education: the Biggs, the Entwistle, and the Vermunt models (Entwistle & McCune, 2004; Vermunt & Donche, 2017; Zusho, 2017).

Biggs (1993), an Australian educational psychologist, stipulated that learning approaches play a central role in students' learning process (i.e., in how students interact with learning situations). Learning approaches are a composite of an intention (i.e., motive) and a process (an appropriate cognitive strategy) and are dynamically associated with some personal and contextual presage factors (e.g., prior knowledge, perceptions of the teaching-learning environment), and with some product factors (e.g., learning outcomes such as generic skills, overall satisfaction).

Entwistle, a British educational psychologist, and his colleagues (Entwistle & McCune, 2004; Entwistle & Ramsden, 1983) proposed a conceptual model based on the everyday experience of studying, which included a greater number of subscales than that of Biggs (1993). Nevertheless, they identified similar learning approaches (deep, surface and strategic). These have been associated with a wide range of variables, such as students' conceptions of learning and students' perceptions of the teaching-learning environment (Entwistle & McCune, 2004). These perceptions, rather than the environment in itself influence students' learning approaches. Thus, perceptions of academic quality (e.g., clarity of goals, good teaching) have been closely associated with how students learn (Entwistle & Peterson, 2004; Richardson, 2009). The latest inventory developed, the Experiences of Teaching and Learning Questionnaire (ETLQ), includes among other scales, a short measure of learning approaches and studying, and a scale of Perceptions of the Teaching-Learning Environment (Entwistle et al., 2003).

Vermunt (1998), a Dutch educational psychologist, also included similar factors to those proposed by Biggs (1993). However, unlike the latter, he extended research on the learning

process by proposing a concept known as learning patterns, which includes an ensemble of four components: learning conceptions, learning orientations, cognitive processing strategies and metacognitive regulation strategies. In the present research, Vermunt's model will be chosen, not in its entirety, but in its last two components. There are three reasons for this. First, learning conceptions and orientations are more stable, whereas learning strategies (cognitive processing and regulation) are less so, tending to be more correlated with contextual factors, and are more specific and adaptive (Vermetten, 1999; Vermunt & Vermetten, 2004). Second, Vermunt's model seems more fully elaborated than those of Biggs or Entwistle. The explanation is that it "expands, refines and updates these models in various ways … include and integrate … cognitive processing strategies … (and) metacognitive-regulation strategies … a component not included by Biggs and colleagues … (or by) Entwistle and colleagues" (Vanthournout et al., 2014, pp 14-16; Vermunt & Donche, 2017). Third, a measure of these strategies could be very helpful to obtain more specific and useful information for validating students' profiles of engagement-burnout and designing possible tailored interventions to improve engagement in those profiles most at risk (Hakanen et al., 2006; Hickendorff et al., 2018; Salmela-Aro et al., 2016), which aligns with the focus and scope of educational psychology.

Learning strategies are student-generated activities aimed to enhance their own learning of the materials presented (Weinstein & Mayer, 1986). In Vermunt's model, students' cognitive processing activities are aimed at processing subject-matter and acquiring new knowledge, basically via deep processing (e.g., relating and organising) or stepwise processing) (e.g., rehearsing, memorising). By contrast, students' regulation processing activities are aimed at planning, regulating and evaluating their own cognitive processing activities and learning. Examples are self-regulation (e.g., planning, testing); external regulation (e.g. allowing one's own learning to be regulated solely by the questions and study-directions provided by the teachers); and lack of regulation (e.g., having difficulties determining whether the subject matter has been mastered) (Vermetten, 1999;Vermunt, 1998 ; Vermunt & Donche, 2017).

Predictors of profile membership

Engagement and burnout have been related to multiple study demands and resources, e.g., study-related personal goals (Salmela-Aro & Upadyaya, 2014) and the right study place (Salmela-Aro & Read, 2017). In this study, we focus on the role of perceived academic quality and perceived stress (both continuous measures). These may be understood in a broad sense, firstly as a study resource and the result of a mismatch between study demands and study resources (Bakker & Demerouti, 2007), within the SD-R framework (Lesener et al., 2020); and secondly as students' perceptions of factors related to the teaching-learning environment in Vermunt's model of student learning (Vermunt, 1998; Vermunt & Donche, 2017). In addition, two demographic factors, students' sex and year of study (both categorical and dummy-coded), were included.

Students' perceptions of academic quality have been shown to be associated with engagement (positively) (Feng, 2018; Guo et al., 2023; Molinari & Grazia, 2021; Tas, 2016) and burnout (negatively) (Meriläinen, 2014; Molinari & Grazia, 2021; Yin et al., 2022).

Thus, as regards academic engagement, Feng (2018) reported that independence, appropriate workload and support for learning emerged in a regression analysis as significant predictors of college students' overall engagement scores. Further, Guo et al. (2023) found,

through longitudinal structural equation modelling, that perceptions of good teaching and teaching organisation in the sophomore year had positive and statistically significant direct effects on students' (later) engagement in their senior year.

With respect to burnout, Molinari and Grazia (2021) identified through LPA four profiles of school engagement-burnout. The more burned-out profiles (the cynically disengaged and the moderately disengaged) generally showed negative scores on many of the dimensions concerning their perceptions of classroom practices (e.g., positive teaching, student involvement) and classroom atmosphere (e.g., student relations; educational climate) while the opposite was true for the other two profiles, the peacefully engaged and the tensely engaged. Moreover, Yin et al. (2022) found, through structural equation modelling, negative relationships between different aspects of international students' perceptions of the teaching-learning environment (specifically, constructive feedback, interest and relevance, alignment, and peer support) and study-related burnout.

Stressors in higher education, e.g., time pressures, perceptions of heavy workload and lengthy assignments (Gusy et al., 2021), are related to perceived stress, which is associated positively with burnout (Byrne et al., 2016; Salmela-Aro & Upadyaya, 2014) and negatively with engagement (Hakanen et al., 2006; Schaufeli, Martínez, et al., 2002). Nevertheless, perceived stress is related to factors such as the field of study, e.g., in comparison with medical students, psychology students showed lower perceived stress risk and developed greater protective coping strategies (Neveu et al., 2012).

There is little consistency in research on demographic factors. The results showed (but only occasionally) that women experience higher engagement and burnout than men and that participants in their last year of study experience higher burnout and lower engagement, e.g., Salmela-Aro and Read (2017), results that are, in this case, linked to the use of a large and diverse sample including all Finnish higher education students. However, we treat these demographic findings with caution because our participants display two typically uneven distributions in social sciences such as psychology.

Outcomes of profile membership

Several potential covariates tied to learning processes (processing and regulation strategies) and learning outcomes (generic skills, satisfaction) were measured. The former aimed at describing them more fully, and the latter aimed at explaining their impact.

With respect to learning processes, the use of measures related to these processes (e.g., self-regulation, learning approaches, learning strategies) has been scarce, particularly for burnout (Asikainen et al., 2020). Asikainen et al. (2022) found that study-related burnout and interest profiles differ in their learning approaches (e.g., those profiles that experienced more burnout showed higher levels of surface learning approach than the less burned out profiles). Researchers have sometimes included these measures related to learning processes as indicators of engagement-burnout profiles, detected through LPA (Ketonen et al., 2016), or used cluster analyses of burnout scores to compare learning profiles defined by learning approach measures (Asikainen et al., 2020).

Although intrinsically interesting, these initiatives would be improved first by excluding learning strategies as profile indicators because they could distort the nature of the profiles (Marsh et al., 2009), and second by describing these learning processes according to Vermunt's (1998) model, for the reasons explained above (e.g., because it includes not only cognitive learning strategies, but also regulation strategies).

Concerning learning outcomes, there is some evidence supporting a significant (positive) link between students' engagement and their generic skill development (Feng, 2018; Guo et al., 2021, 2023) and satisfaction with university programmes (Guo et al., 2021, 2023). Thus, for example, Feng (2018) found that many engagement dimensions (e.g., interest in courses, community participation and relations with others) predicted students' generic skills and satisfaction. Guo et al. (2021) reported that college students' engagement predicted their learning satisfaction and generic skills development. Similarly, Guo et al. (2023) showed that students' generic skills development in senior years, which was higher than in sophomore years, was predicted by the students' initial level of engagement. This was measured by using an inventory including several scales (e.g., student-faculty interaction, course study).

Moreover, despite the traditional link between burnout and job satisfaction (Goering et al., 2017), very little research has explored that link in the context of the SD-R framework.

The present study

The purpose of this study was to fill three gaps detected in research on the academic engagement-burnout relationship as most of the research was conducted: i) without analysing all its multiple dimensions; ii) from a variable-centred perspective, and iii) in educational contexts other than higher education. Taking a person-centred perspective (an LPA), the aims of this study were twofold: first, to identify the different profiles (i.e., patterns or configurations) of academic engagement-burnout that emerge when all the dimensions of these constructs are used. Second, to validate these profiles by examining their differences in terms of a set of important, but external or auxiliary variables (i.e., predictors and outcomes) related to psychology and education and grounded on theoretical models relevant to higher education.

Our study contributes to previous research on this issue by firstly identifying the most naturally occurring profiles of academic engagement-burnout, and secondly, detecting significant differences among them (i.e., validating them) in a set of external variables, variables which are linked to recent theoretical models relevant to higher education such as the SD-R (Lesener et al., 2020) and Vermunt's (1998) model of learning, and that provide a better understanding of inter-individual heterogeneity in order to design tailored interventions.

Thus, the research questions (RQ) and hypotheses (H) are as follows.

Research questions and hypotheses

(RQ1). Which profiles emerge from the combination of scores on all the engagement (UWES-S) and burnout (MBI-SS) scales?

H1. Four profiles, ordered in terms of levels of engagement and burnout, can be detected among higher education students:
two profiles showing high/low levels of engagement/burnout, i.e., high levels of engagement and low levels of burnout (engaged) and high levels of burnout and low levels of engagement (burned-out); and two profiles showing moderately above/below average levels of engagement/burnout, i.e., moderately engaged and moderately burned-out, respectively.

(RQ2). Which covariates (perceived academic quality, perceived stress, year of study, and sex) predict the likelihood of profile membership?

H2. There is a significant association between most of these variables and profile membership. Thus, the likelihood of engaged and moderately engaged profiles is higher for those students with lower perceptions of stress and higher perceptions of academic quality. Moreover, the likelihood of burned-out profiles is higher for males than for females.

(RQ3). How do scores on learning strategies (processing and regulation) and learning outcomes (generic skills, satisfaction) covariates differ as a function of profile membership?

H3. Students' scores (means) on learning strategies and learning outcomes are generally ordered from the least to the most desirable (generally, low to high levels) and significantly associated with the ordered profiles, from *burned-out to engaged*.

Method

Participants, procedure and measures

The participants were 430 psychology students, of whom 2 were dropped because they missed more than three responses in the preliminary analyses at the item level. Missing values were minimal (<1%) and imputed using the k-nearest neighbours (kNN) method. Most of the final 428 participants were female (84.1%); aged between 18 and 25 (96%); and enrolled in their 1st year (200), 2nd year (112), 3rd year (66) or 4th year (50) of undergraduate training at a major state-supported university. They displayed two uneven distributions typical in social sciences such as psychology: more women than men and fewer participants in their last year of study. All were informed about the purposes of the study, gave informed consent to participate and voluntarily completed a series of questionnaires in class.

The participants complete the 30 items of the Course experience questionnaire (CEQ, Wilson et al., 1997), in conjunction with a 5-item measure of Satisfaction (Grace et al., 2012); the 10 items of the Perceived Stress Scale (PSS, Cohen et al., 1983); the 22 processing strategies items and the 28 regulation strategies items of the ILS (Vermunt, 1998); and the 15-item MBI-SS and the 17 items of the UWES-S (Schaufeli, Martínez, et al., 2002). The PSS items were slightly modified to relate stress experience to academic study (e.g., "How often have you felt unable to control the important things in your academic life?"). Items were anchored on i) 5-point Likert-type scales ranging from 1 ('never or rarely true of me') to 5 ('always or almost always true of me') (CEQ, Satisfaction and ILS) or from 0 (Never) to 4 (Very often) (PSS); or ii) 7-point Likert-type scales ranging from 0 (Never) to 6 (Always) (UWES-S and MBI-S).

Study design

Definition

The design of this study was cross-sectional, focused on a person-centred perspective, and more specifically, on a finite mixture model such as LPA, including covariates (Harring

& Hodis, 2016). This is increasingly used in educational psychology (Harring & Hodis, 2016), based on probability theory and aiming "to probabilistically assign individuals into subpopulations by inferring each individual's membership to latent classes from the data" (Berlin et al., 2014, p. 175). In other words, mixture models are exploratory, probabilistic and typological (Morin & Litalien, 2019).

Main stages

LPA began by exploring the underlying optimal number of profiles (best-fitting model) on the basis of the indicator variables only (i.e., all dimensions of engagement and burnout). Having selected the best-fitting model, covariates (i.e., external variables, in other words, the remaining variables) were included in the model, some as antecedents (i.e., predictors) and some as consequents (i.e., outcomes) to validate the latent profiles identified (e.g., Nylund-Gibson & Masyn, 2016). This validation involved an examination of the associations between three blocks of variables: first, the antecedents (A) (e.g., perceptions of the learning environment) and the profiles (P); and second, those profiles (P) and the consequents (C) (e.g., learning outcomes) (Bolck et al., 2004).

N.B.

Interestingly, in the study design of the current research, there are several associations not typically examined because they are more characteristic of a variable-centred perspective. They correspond to the associations between: i) antecedents and consequents; ii) antecedents with each other; and iii) consequents with each other. Moreover, the cross-sectional nature of this design implies that causality or directionality of the relations examined cannot be inferred (Morin et al., 2023).

Data analyses

These were performed in Mplus 8.8 (Muthén & Muthén, 1998–2022) and included measurement models conducted in two stages, followed by LPAs.

Preliminary analyses

These measurement models were estimated using factor scores from exploratory structural equation modelling (ESEM) used in an exploratory way (geomin rotations) and a confirmatory way (target rotations) (Morin et al., 2020) (see Online Resource 1) (the Supplementary Material for this article can be found online at -private sharing link- https://figshare.com/s/27c51a48cda56743ea74).

The results of the confirmatory analyses (see Table 1) showed acceptable goodness-of-fit indices (e.g., CFI >.94 and TLI >.90) for the measurement models underlying the different constructs.

Satisfaction and generic skills were defined by a single factor, whereas the remaining constructs were based on two or more first-order correlated factors, including the CEQ, with four first-order factors satisfactorily loading on a higher-order factor (perception of academic quality) (CFI= .979, TLI= .960, RMSEA= .047). The composite reliabilities of these models were acceptable ($\omega \geq .636$). Additional information on descriptive statistics,

Table 1 Goodness-of-fit statistics and information criteria for the ESEM measurement models

Models	χ^2	df	CFI	TLI	RMSEA	90% CI
- *Predictors*						
CEQ (one high-order factor)[a]	125.690	.64	.979	.960	.047	[.035-.060]
PSS (two-factor)[b]	106.499	26	.977	.959	.085	[.060-.102]
- *Engagement and Burnout*						
UWES-S (three-factor)[c]	50.106	25	.996	.992	.048	[.029.068]
MBI-S (three-factor)[d]	25.511	12	.997	.990	.051	[.023.079]
- *Outcomes*						
Regul. strat. (three-factor)[e]	124.234	42	.947	.901	.068	[.054-.082]
Proces. strat. (two-factor)[f]	299.025	103	.954	.940	.067	[.058-.076]
Generic skills (one-factor)[g]	4.317	2	.996	.989	.052	[.000-.121]
Satisfaction (one-factor)[h]	18.610	5	.997	.995	.080	[.043-.120]

Numbers in brackets correspond to the number of items. a = with four first-order factors: appropriate assessment (4), appropriate workload (4), good teaching (3), and clear goals (5). b = Stress (including all the negative phrased items -no reverse scoring-) and Counterstress (including all the positively phrased items -reverse scoring-). c = Absorption (4), Dedication (4), and Vigour (3). d = Cynicism (3), Exhaustion (3), and Inefficacy (3). e = Self-regulation (6); External regulation (4) and Lack of regulation (3). f = Deep processing (11) and Stepwise processing (6); g = 4 items. h = 5 items.

correlations, reliability and validity is given in Online Resource 2, and the Mplus code is provided in Online Resource 3.

Results

Profile enumeration and retention

First, we evaluated a series of iterative models with 1-5 profiles in which the means (and variances) were freely estimated within each profile (Masyn, 2013). To avoid convergence, ineffective analyses and high computational time, these models were estimated stepwise: first, using 5,000 random starts and 1,000 iterations for each random start and retaining the 200 best solutions (e.g., Busque-Carrier et al., 2021) and second, requesting separately the Lo–Mendell–Rubin test (VLMR-LRT) and its bootstrapped likelihood ratio test (BLRT) (see Asparouhov & Muthén, 2012).

An inspection of model fit and criteria diagnostic (Table 2) pointed to the three-profile model as the best-fitting because firstly, the p value for the VLMR-LRT and the BLRT were significant (p <.001) for 2–3 latent profile models, whereas they were not for 4-5 profile models; secondly, it yielded both satisfactory entropy (≥.80) and the smallest class size (>5%); and thirdly it was supported by theory, ease of interpretation and acceptable statistical criteria (e.g., BIC, SABIC) (lower values suggesting better model fit) (Ferguson et al., 2020).

The best-fitting model included three profiles: two involving high/low levels (from ≈0.5 to ≈1.0 SD) above/below the mean in all dimensions of burnout and engagement (burned-out) or in engagement and burnout, respectively (engaged), and one involving weaker levels, close to the average (from ≈0.5 or less SD) above/below the mean in all dimensions of engagement and burnout, respectively (moderately engaged). The two former profiles

Table 2 LPA model fit and diagnostic criteria

Model	LL	#fp	AIC	BIC	SABIC	Entropy	SCS (%)	VLMR-LRT *p* value	BLRT *p* value
1 Profile	-3317.779	12	6659.558	6708.268	6670.187			<.001	
2 Profiles	-2919.332	25	5888.664	5990.142	5910.807	.827	46.49	<.001	<.001
3 Profiles	**-2760.934**	**38**	**5597.867**	**5752.114**	**5631.525**	**.860**	**16.58**	**<.001**	**<.001**
4 Profiles	-2699.687	51	5501.375	5708.390	5546.547	.808	12.85	.512	*
5 Profiles	-2649.094	64	5426.188	5685.972	5482.875	.820	10,74	0.286	<.001

LL log-likelihood; #fp = number of free parameters; *AIC* Akaike information criterion; *BIC* Bayesian information criterion; *SABIC* sample-size adjusted BIC; *SCS* smallest class size; the most appropriate profile is presented in bold. (*) convergence issues.

included 32.01% and 16.59% of students, whereas the latter two included the remaining 51.40%, i.e., 83.41% fell into the burned-out and moderately engaged profiles. Results from this three-profile solution are represented in Fig. 1.

Predictors of profile membership

Four covariates were added to the best-fitting model and tested as predictors of latent profile membership in multinomial logistic regression analyses (Table 3).

The results show that, whereas the participants' year of study was unrelated to the likelihood of profile membership, the latter was statistically significantly associated with students' sex, in that males were more likely than females to be in the *burned-out* rather than

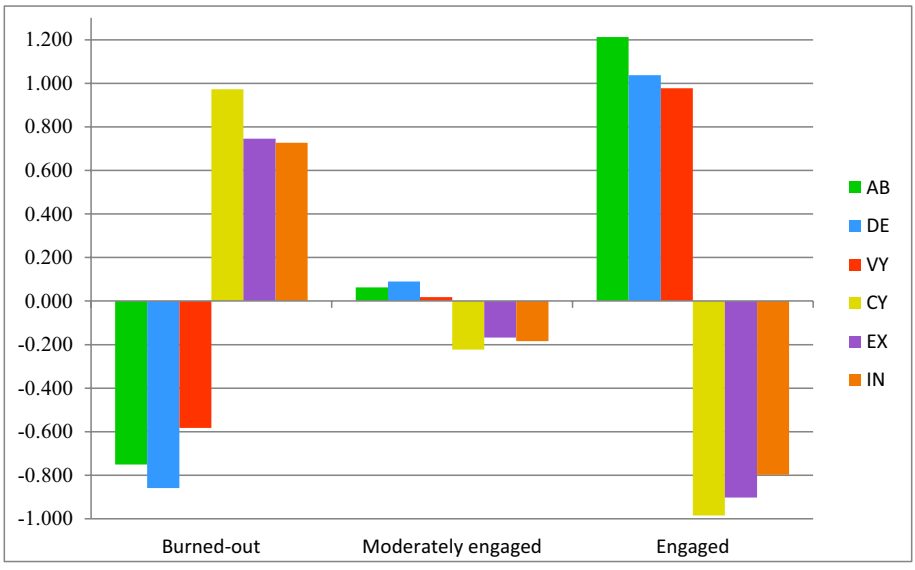

Fig. 1 Means of Engagement (AB, DE, VI) and Burnout (CY, EX, IN) for each Profile. *Note*: Engagement (AB: Absorption; DE: Dedication; VY: Vigour). Burnout (CY: Cynicism; EX: Exhaustion; IN: Inability)

Table 3 Multinomial logistic regressions: contribution of predictors to profile membership

	P1 vs. P2[a]			P2 vs. P3[a]			P1 vs. P3[a]		
	Coeff.	SE	OR	Coeff.	SE	OR	Coeff.	SE	OR
Sex	1.142**	.399	3.135	1.021	.581	2.777	2.164***	.524	8.703
Year 2	-.380	.249	.684	-.030	.319	.971	-.410	.255	.664
Year 3	.277	.267	1.319	-.279	.352	.757	-.002	.307	.998
Year 4	-.035	.291	.966	-.114	.433	.892	-.149	.374	.861
H_CEQ_1F	-.798***	.243	.450	-.802***	.319	.448	-1.600***	.228	.202
POS_STRE	.553*	.272	1.739	-.441	.327	.643	.112	.254	1.119
NEG_STR	.655**	.275	1.925	.689**	.319	1.992	1.344***	.264	3.833

[a]Reference group. Year of study and sex were dummy-coded (1st year as the reference group; female 0, male 1). P1 = *Burned-out*; P2 = *Moderately engaged*; P3: *Engaged*. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

in the remaining profiles. Furthermore, profile membership was also related to students' perceptions of academic quality. The lower their scores on these perceptions, the more likely their probability of belonging to the *burned-out* rather than the *moderately engaged* or the *engaged* profiles. In addition, the profiles showed significant associations with negative stress, in that in all the pairwise comparisons, the students reported higher scores in the comparison group than in the reference group. Finally, positive stress also showed positive associations, but only with regard to the comparison of the *burned-out* profile with the *moderately engaged* profile. Given that item scores on counterstress were reverse-scored, higher scores denote lower perceived coping ability.

Outcomes of profile membership

Three groups of outcomes (regulation strategies, processing strategies and learning outcomes) were incorporated into the best-fitting model to assess how they were predicted by profile membership in multinomial logistic analyses. As Table 4 depicts, all outcomes except lack of regulation and stepwise processing yielded statistically significant mean-level differences (Wald test) between most of the profiles.

For example, the results on regulation strategies reveal that scores on self-regulation were significantly differentiated between the three profiles; e.g., the mean levels in

Table 4 Multinomial logistic regression: Outcomes of Profile Membership

Outcomes	P1	P2	P3	1 vs. 2	2 vs. 3	1 vs. 3	Summary of comparisons
SELF_REG	-.282	.051	.505	-.333**	.-454***	.-787***	3 > (1,2); 2 >1
EXT_REG	-.315	.114	.335	-.429***	-.222	-.650***	3 > (1); 2 > 1
LACK_R	.067	-.076	-.141	.143	.065	.208	3 = 2 = 1
DEEP_PR	-.136	.024	.472	-.161	-.448**	-.609***	3 > (1, 2)
STEP_PR	.017	.071	-.117	-.054	.188	.134	3 = 2 = 1
G_SKILLS	-.287	.182	.466	-.469***	-.284*	-.753***	3 > (1,2); 2 > 1
SATISFAC	-.318	.047	.099	-.365***	-.052	-.417***	3 > 1; 2 > 1

P1=Burned-out; *P2* = Moderately engaged; *P3*: Engaged. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

self-regulation were higher in the *engaged* (M=.505) profile than in the *burned-out* and *moderately engaged* profiles (M= -.282, and .051, $p<.001$, respectively).

Interestingly, a glance at Table 4 tells us that i) the profiles varied along a continuum, ranging from burnout to engagement, and ii) the outcomes seemed to be ordered along a continuum across the profiles, generally ranging from low to high levels on the most desirable outcomes. Statistical differences among these means were significant for all three comparisons in self-regulation and generic skills and two of the three comparisons for external regulation, deep processing and satisfaction. The most desirable outcomes were generally associated more strongly with the two *engaged* profiles than with the *burned-out* profile. More precisely, the singularity of these profiles was statistically significant even when comparing the engaged and the moderately engaged profiles. The latter showed lower scores on learning strategies (self-regulation and deep processing) and learning outcomes (general skills), which may bring the moderately engaged closer to risk of burnout.

Discussion

This research was designed to expand our understanding of the nature of the academic engagement-burnout relationship in response to Leiter and Maslach's (2016, 2017) claims. We focused on higher education students, confirmed the measurement models of the latent constructs through confirmatory ESEM, and adopted a person-centred perspective. This was tied to our first aim, to detect the different profiles of academic engagement-burnout that emerge when all the dimensions of the UWES-S and the MBI-SS are examined simultaneously. Our second aim was to validate these profiles by examining their associations with a set of important, but external variables (i.e., predictors and outcomes) linked to some theoretical models relevant for academic settings and educational psychology (Lesener et al., 2020; Vermunt, 1998).

Regarding H1, a three-profile rather than a four-profile model shows the best fit to the data. The *engaged* and *burned-out* profiles are in line with those found by Salmela-Aro et al. (2016), Salmela-Aro and Read (2017), and Tuominen-Soini and Salmela-Aro (2014). However, the third profile, *moderately engaged,* involves weaker levels; its hypothesised counterpart, *moderately burned-out*, is not included in the best-fitting model. These findings partially confirm H1 and significantly differ from the profiles reported by other researchers, e.g., inefficacious (around the mean in all the scales) (Salmela-Aro & Read, 2017) and engaged-exhausted (moderate levels of burnout and engagement) (Salmela-Aro et al., 2016; Salmela-Aro & Read, 2017; Tuominen-Soini & Salmela-Aro, 2014). These differences can be explained in part by some methodological and theoretical issues.

Methodologically, our study involved some improvements. We included all the engagement and burnout dimensions rather than composite scores of the three dimensions of burnout and all the items of engagement, which may have provided a more nuanced approach (Schaufeli & De Witte, 2017). Moreover, we used ESEM to derive factor scores rather than mean scores, which may have facilitated both the control of measurement errors and interpretation of the results and provided a maximum differentiation between constructs (Busque-Carrier et al., 2021; Morin et al., 2017). Finally, we explained that instead of simply not referring to the indicators' variances or using the default method in Mplus, our LPA does not require class invariance. This enhancement may have helped fulfil a triple purpose: avoiding the tendency to overextract profiles typical of constrained models, capturing

the underlying heterogeneity being modelled; and supporting a substantive interpretation of the latent profiles (Nylund-Gibson & Choi, 2018).

Theoretically, these findings strongly suggest that engagement and burnout are related but distinct constructs in the academic setting of higher education, which is in agreement with Schaufeli, Salanova, et al.'s (2002) perspective. However, importantly, these constructs do not appear to co-occur within individuals, given their clear-cut, distinctive engagement-burnout z scores above/below the mean in all dimensions. In other words, the combinations of engagement-burnout that define our three latent profiles do not seem to be aligned (e.g., high, moderate, and low levels on both engagement and burnout) but are discrepant (i.e., high engagement/low burnout). This is in contrast with Leiter and Maslach's (2017) view of them as opposite poles between which some potential patterns of co-occurrence might exist. More than co-occurrence, what seems evident is the independence of engagement and burnout at different levels (high/low and weaker levels), which is made manifest in the detected profiles and in their subsequent validation. This might be partly explained by the way in which engagement and burnout concepts were operationalised (through the UWES and the MBI, respectively), as expressed by Schaufeli and De Witte (2017). Instruments that "were developed with an eye on the state captured by extreme scores", as suggested by Leiter and Maslach (2017, p. 56).

Generally consistent with H2, the results of the present study support the role of the various covariates in predicting profile membership.

First, perceptions of academic quality and negative stress show somewhat similar results of an increased likelihood of membership in the standard profiles (e.g., *engaged* relative to b*urned-out*) and in the standard and moderated profiles (i.e., *engaged* relative to *moderately engaged*). These results go beyond previous research showing links between either engagement or burnout and perceptions of academic quality and (negative) stress (Byrne et al., 2016; Feng, 2018; Meriläinen, 2014; Schaufeli, Martínez, et al., 2002), offering a slightly more detailed picture of these links.

Surprisingly, students' perceived (positive) stress is a significant predictor of profile membership only when the *burned-out* profile is compared with the *moderately engaged* profile, but not in the remaining comparisons. Two related features might explain this discrepancy: the factor structure of the PSS and the links between perceived stress and field of study. The former includes two correlated but qualitatively distinct components of stress (Lee, 2012), while the latter is based on Neveu et al.'s (2012) findings revealing better protective coping strategies in psychology students than in students in other fields. These findings might suggest, in terms of the SD-R framework (Lesener et al., 2020), applied to university settings, that many of the psychology students participating in this research tended to manifest a satisfactory balance between their perceived study demands and resources.

Second, regarding the two demographic covariates, the profile likelihood was not significantly associated with the participants' year of study, but it was with their sex. Although these results are more or less in line with the abovementioned inconclusive results regarding these demographic factors, they corroborate the appropriateness of determining their role in both predicting profile membership and controlling their possible influence on outcome measures.

Generally consistent with H3, the students in the *engaged* profile showed higher levels of self-regulation and deep processing than those in the *burned-out* and *moderately engaged* profiles. Moreover, the latter displayed higher levels of self-regulation and external regulation than those in the *burned-out* profile. This in turn reveals lower levels of external regulation than in those in the *engaged* profile. These results are new and enhance our understanding of the associations between heterogeneity in students' combinations of

engagement-burnout and most of their regulation and processing strategies, thus expanding the scarce literature in this area (Asikainen et al., 2020) linked to educational psychology.

Our results do not support the significant association between a lack of regulation and the *burned-out* profile reported by Ketonen et al. (2016), possibly because they used a lack of regulation together with exhaustion as indicators of the profiles rather than as covariates. Likewise, although Asikainen et al. (2020) reported that the surface approach was significantly related to the *burned-out* profile, we detected no significant link between that profile and stepwise processing, a construct that is related but not identical to the surface approach (Vermunt & Donche, 2017). Thus, these differences might be partly due to the use of different measures, indicators and theoretical frameworks, which confirms Bae and DeBusk-Lane's (2019) suggestion that comparisons between profiles from different studies should be made with caution.

Our results also support H3 regarding learning outcomes, as the students in the *engaged* and *moderately engaged* profiles displayed higher levels of generic skill acquisition than those in the *burned-out* profile. Regarding the outcome of satisfaction, the results are similar, except for the nonsignificant differences between the two *engaged* profiles. These results i) concur with those obtained in previous variable-centred research on engagement (Feng, 2018; Guo et al., 2021) and ii) extend the link between burnout and job satisfaction previously observed in the JD-R framework to the SD-R framework (Goering et al., 2017).

In addition, after controlling for the covariates, the observation of a desirability-based continuum of learning processes and outcomes, generally higher for the *engaged* profiles than for the *burned-out* profile, contributes to the literature by providing a finer-grained validation of those profiles in which engagement and burnout are considered simultaneously. Regarding the relationship between engagement and learning processes, it seems that the former tends to improve the latter, in line with the results of some variable-centred studies(e.g., Kong et al., 2003), and that this improvement tends to be associated with desirable outcomes (i.e., satisfaction, generic skills). Interestingly, regarding the relationship between academic burnout and learning processes, it appears that the former tends to impair the latter, as suggested by Asikainen et al. (2020), and that this impairment tends to be associated with less desirable outcomes (i.e., lower levels of generic skills and satisfaction).

Limitations and future directions

Our study has several potential limitations. All participants were undergraduate psychology students from the same university, which, together with the exploratory nature of LPA, may have limited our ability to generalise the findings. Moreover, the cross-sectional mixture model design we used did not allow us to ascertain the directionality of the associations between profiles, predictors and outcomes, thus providing only a 'snapshot' of the engagement-burnout interplay, constraining possible inferences of causation between the variables examined. Finally, although our selection of possible psychological predictors and outcomes of the engagement-burnout profiles was anchored in the SD-R framework, it was necessarily limited by the complexity of the mixture model used.

Further studies are needed for three purposes. Firstly, to replicate the present findings with a large and diverse group of disciplines (e.g., medicine, nursing, engineering) in different universities and explore fitting models that could include additional engagement-burnout combinations in academic settings (e.g., moderately burned-out profile). Secondly,

to conduct longitudinal studies aimed at examining the dynamic engagement-burnout interplay across long time periods (e.g., throughout students' degree studies) and its causal links with predictors and outcomes, which would facilitate confirming the motivational and health impairment processes proposed in the SD-R framework (Lesener et al., 2020). In addition, as suggested by one referee, the bidirectional and dynamic relationship among the different elements of well-known models of learning (e.g., Biggs, 1993; Entwistle et al., 2003; Vermunt, 1998) would enable researchers to focus on exploring the profiles of students' learning process (e.g., learning approaches, learning strategies), examining their associations with academic engagement, burnout and some other variables. This could possibly be followed by longitudinal studies. Thirdly, to analyse other possible psychological predictors (e.g., emotional demands, teacher support) (Lesener et al., 2020) and outcomes (e.g., learning patterns, lifelong learning skills) (Vermunt & Donche, 2017).

Implications for theory and methodology in higher education

From a theoretical perspective, our findings reveal that engagement and burnout are independent but linked constructs that do not explain one another, which would require assessment with multiple instruments, and that there is scope to research their interplay using longitudinal studies in particular (Leiter & Maslach, 2017; Schaufeli & De Witte, 2017). Moreover, they support the viability of accommodating students' perceived academic quality and perceived counterstress, as well as their learning processes (i.e., processing and regulation strategies) and learning outcomes (i.e., generic skills and satisfaction), as relevant variables in the SD-R framework (Lesener et al., 2020).

In terms of methodology, throughout this study, special emphasis has been placed on three key aspects of interest for researchers and practitioners. First, by using composite variables (e.g., factor scores) derived from ESEM measurement models of the latent constructs (used in a confirmatory way) to facilitate model convergence. Second, by using LPA, which has advantages over cluster analysis in being model-based rather than exploratory and providing statistically fit indices and because the assignment of individuals to the profiles is done in a probabilistic framework rather than using a distance measure (Nylund et al., 2007). Finally, by providing detailed information about the theoretical and statistical decisions involved in LPA, in particular those related to model specification (Nylund-Gibson & Choi, 2018), with the triple purpose of avoiding over-extracted profiles, finding the model likely to best represent the data and aiding comparisons between profiles from different studies as much as possible.

These implications for theory and methodology result from the interplay between diverse theoretical perspectives all relating to European psychology research (e.g., Lesener et al., 2020; Schaufeli, Martínez, et al., 2002) and from the combination of relatively new methodological tools such as ESEM and LPA (e.g., Bae & DeBusk-Lane, 2019; Harring & Hodis, 2016), respectively.

Taken together, they can provide the basis for expanding research in educational psychology and contributing not only to theory and methodology, but also to educational practice.

Implications for practice

First, our findings highlight the importance of considering all dimensions of students' engagement and burnout together and analysing them using a powerful person-centred

analytic tool such as LPA. This does not operate, as variable-centred analyses do, by assuming homogeneity in the students' responses and searching for general laws or models in a single population. LPA operates by assuming heterogeneity between learners (i.e., there are various subpopulations or subgroups), with several advantages. The first is that it permits the identification of naturally occurring configurations of variables at the individual level (i.e., in the different subgroups), configurations of engagement and burnout that it would have been impossible to detect by using variable-centred analysis (Nylund et al., 2007; Woo et al., 2024). This is an important issue for educators and educational psychology researchers interested in understanding the nature of student learning and adapting instruction for all learners (Berliner, 1993). These interests can be better achieved by exploring the covariates (i.e., antecedents and outcomes) of these configurations, an exploration which must include students' learning processes and start at the beginning of their higher education studies (Salmela-Aro et al., 2016; Salmela-Aro & Read, 2017).

A second and particularly salient advantage of LPA is how easily the complex relationships between the profiles (i.e., engagement-burnout, in this case) and their uniquely related covariates can be modelled. These relationships can enable educators, *inter alia*, to identify potential relative risk profiles, better understand learning and individual differences and design tailored interventions for particular profiles (Hickendorff et al., 2018; Nylund et al., 2007).

Our findings support the distinctiveness of the three detected configurations and suggest that not only the *burned-out* but also the *moderately engaged* may be described as at risk. For the sake of clarity, we will refer first to the outcomes and then to the antecedents.

According to the desirability-based continuum of the outcomes, higher priority should be given to those students who experience higher education in terms of feeling burned-out, followed by those who feel just slightly engaged. For the *burned-out* students with a risk profile in accordance with their poor learning strategies and learning outcomes, a range of interventions seems to be effective in diminishing burnout. Tang et al. (2021) mention psychosocial training, time management, exercise intervention, and group counselling (the most widely utilised). In addition, Madigan et al. (2023) indicate others such as cognitive behavioural therapy and rational emotive behaviour therapy.

Moderately engaged students should also receive attention and support from their instructors on three grounds. Firstly, their scores in engagement and burnout are close to the average, which suggests that they are between not burned-out and burned-out, and between engaged and not engaged. Secondly, these scores are lower than those of students assigned to the *engaged* profile regarding learning strategies (self-regulation and deep processing) and learning outcomes (general skills, e.g., problem-solving, ability to plan work). And thirdly, these strategies are essential in Vermunt's model of learning (Vermunt & Donche, 2017) and these outcomes are fundamental in the current competency and outcome-based models in higher education (Gover et al., 2019). The latter entail demands that may promote not only engagement but also stress and burnout (e.g., Asikainen et al., 2020; Gusy et al., 2021; Schaufeli, Martínez, et al., 2002).

On these grounds, *moderately engaged* students are placed at risk of burnout, and this risk and their diminished engagement deserve attention. Therefore, the interventions mentioned above and highlighted in some reviews (Madigan et al., 2023; Tang et al. 2021) may help prevent burnout. Furthermore, there is research evidence on the effectiveness of i) study crafting (i.e., students' vigorous adaption to resources and demands) to enhance engagement and diminish exhaustion (e.g., Körner et al., 2023), and ii) mindfulness to improve self-regulation and engagement (e.g., Hammill et al., 2023).

The results regarding the antecedents of the detected profiles could also have many important practical educational implications. The finding that positive perceptions make students more likely to be engaged and less likely to be burned-out underline how necessary it is that instructors seek to design and implement high quality teaching-learning environments. Environments characterised by good teaching (e.g., motivating the students to do their best work), clear goals (e.g., specifying what is expected from students) and appropriate assessment (e.g., providing constructive feedback). Further, an appropriate workload (e.g., not addressing too many topics in the syllabus) seems imperative (e.g., Guo et al., 2021; Meriläinen, 2014; Molinari & Grazia, 2021; Vermunt & Donche, 2017; Yin et al., 2022).

Likewise, given the link between students' perceptions of negative stress and their profiles of engagement-burnout, a mixture of organisational and individual strategies is needed to address their impact, as recommended by Madigan and Curran (2021).

At the organisational level, a reduction of high demands in study programmes (e.g., excessive assignments, perceived workload, time pressure) is proposed and, in parallel, an increase of study resources (e.g., teacher support) (Gusy et al., 2021; Lesener et al., 2020). Moreover, higher education institutions should offer services and programmes oriented to assist students (e.g., in stress and time management, active coping) (Lin & Huang, 2014; Robotham, 2008), at both the general and the individual level. At the individual level, the behavioural, cognitive, and mindfulness interventions seem the most effective anti-stress interventions (Regehr et al., 2013).

A high priority in the application of these interventions should be given to the burned-out students, followed by the moderately engaged, who are at risk of academic burnout (e.g., Lin & Huang, 2014; Salmela-Aro et al., 2016).

Taken together, these implications confirm the construct validity of the extracted profiles and also their utility. Thus, the initiatives for optimising students' learning experience with regard to academic engagement and burnout involve a comprehensive understanding of it as a complex network of intertwined constructs embedded in the teaching-learning environment.

In conclusion, the aim of this study was to identify, through LPA, which profiles of students' academic engagement and burnout emerged and validate them on a wide range of psychological covariates (predictors and outcomes) grounded in theoretical models relevant to higher education. The findings revealed three profiles (*engaged, moderately engaged,* and *burned-out*), which showed coherent patterns of association with some predictors (e.g., perceived academic quality, sex, negative stress) and outcomes. The latter appeared to be ranked on a desirability-based continuum, with the most desirable outcomes (e.g., self-regulation, deep processing, generic skills) being generally more related to the *engaged* profiles than to the *burned-out* profile. Taken together, the findings i) emerge from a combination of several theoretical models all relating to European psychology research and advanced methodological tools, all associated with educational psychology research; ii) increase our understanding of the nature of academic engagement and burnout as related but independent constructs at different levels (high/low and weaker levels) and iii) hold practical implications for researchers, teachers, and academic authorities.

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Data availability The datasets for this study are not are not readily available because the consent from participants did not include their agreeing to their data being shared.

Code availability Nevertheless, some examples (excerpts) of Mplus code for the main statistical analyses are provided in the supplementary material (see Online resource 3).

Declarations

Competing interests The authors declare no competing interests.

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Learning patterns. Engagement and burnout in higher education. Exploratory Structural Equation Modeling (ESEM).

Most relevant publications in the field of Psychology of Education:

Shum, A., Fryer, L.K., Cano, F., Berbén, A.B:G., Pichardo, M.C. (2021). Nature vs nurture: learning conceptions and environment as precursors to learning strategy patterns and their outcomes. *Higher Education Research & Development, 41*(7), 2408-2425. https://doi.org/10.1080/07294360.2021.1985088

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Current themes of research:

Educational intervention.

Current themes of research:

Social competence development in early childhood. Abuse of teachers. Prevention of behavioral problems in both school and family contexts.

Most relevant publications in the field of Psychology of Education:

Justicia-Arráez, A., Pichardo, M. C., Romero-López, M., & Alba, G. (2021). Can We Manage Behavioral Problems through the Development of Children's Social-Emotional Regulated Behavior? Longitudinal Study of a Preschool Program. *International Journal of Environmental Research and Public Health, 18*(16)*,* 8447. https://doi.org/10.3390/ijerph18168447

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Most relevant publications in the field of Psychology of Education:

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Current themes of research:

Learning and training in Higher Education. Teacher training. Academic and psychosocial development in schools. Family and gender studies.

Most relevant publications in the field of Psychology of Education:

Shum, A., Fryer, L.K., Cano, F. Berbén, A.B.G. & Pichardo-Martínez, M.C. (2022). Nature vs nurture: learning conceptions and environment as precursors to learning strategy patterns and their outcomes, *Higher Education Research & Development, 41*(7), 2408-2425. https://doi.org/10.1080/07294360.2021.1985088

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