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# Configurations of regulatory focus and directing attention and their associations with autonomy, competence, and relatedness need satisfaction/frustration

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## ABSTRACT

**Objective:** The first objective of this research was to investigate the interrelationships of regulatory focus (i.e. promotion and prevention) and the ability to direct attention when studying. The second was to examine whether unobserved groups of individuals having distinct combinations of regulatory focus and directing attention differed on satisfaction/frustration of their basic psychological needs.

**Method:** Data were collected from 307 undergraduate students from the US. Latent profile analysis was used to uncover the unobserved groups defined by distinct configurations of promotion, prevention, and directing attention and to examine differences among these groups with regard to satisfaction/frustration of basic needs.

**Results:** Three latent groups were identified. Students who had high levels of promotion, prevention, and directing attention, also had strong satisfaction and weak frustration of their psychological needs. Students with low promotion, prevention, and directing attention, also had strong frustration and weak satisfaction of their psychological needs.

**Conclusions:** The adaptive pattern of self-regulation, characterized by strong promotion, prevention, and directing attention, was also associated with an adaptive combination of high need satisfaction and low need frustration. A less adaptive pattern of low promotion, prevention, and directing attention was also associated with a maladaptive combination of high need frustration and low need satisfaction.

## KEY POINTS

### What is already known about this topic:

- (1) Promotion and prevention influence how people set and pursue goals.
- (2) The ability to direct attention to study materials is a key predictor of learning and achievement in school settings. Both satisfaction and frustration of basic psychological needs are related to how students engage in learning and how well they achieve.
- (3) This study uncovers, for the first time, the patterns of interrelationships (i.e. configurations) among key contributors to effective self-regulation, namely promotion, prevention, and ability to direct attention.

### What this topic adds:

- (1) Students whose configurations involved high levels of promotion, prevention, and directing attention, also had strong satisfaction and weak frustration of their psychological needs.
- (2) Students whose configurations comprised low levels of promotion, prevention, and directing attention, also had strong frustration and weak satisfaction of their psychological needs.

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## KEYWORDS


Promotion; prevention; directing attention; basic psychological need satisfaction; basic psychological need frustration; latent profile analysis

## Introduction

Students' engagement in learning tasks and the quality of their learning are shaped by how motivated they are and how effectively they direct their attention during studying (Bjork et al., 2013; Cermakova et al., 2010; Dinsmore et al., 2017; Dunlosky et al., 2013). Thus, being motivated and managing to effectively direct

attention to learning tasks/materials are critical for the success of learning (Bjork et al., 2013; Hicks et al., 2021; McCrudden & McNamara, 2017; McDaniel & Einstein, 2020). Considering that motivation and directing attention may interact to influence how students learn, the impact of either factor cannot be fully grasped if motivation and attention are considered in

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isolation. Therefore, it is critical that the associations between motivation constructs and directing attention are mapped to enable the identification of adaptive motivation – (directing) attention configurations that could be supported (or altered) in educational settings.

In addition to examining motivation – directing attention configurations, this research aims to further advance understanding of the relationships between motivation factors that are couched in two key motivation theories (i.e., regulatory focus; Higgins, 1997, 2012, basic psychological needs theory; Ryan & Deci, 2017; Ryan et al., 2021, 2022; Vansteenkiste & Ryan, 2013; Vansteenkiste et al., 2020). To attain these aims and bridge the attendant gaps in current knowledge, the present investigation first identifies unobserved configurations/patterns of regulatory focus and directing attention. Subsequently, it assesses the extent to which groups that have different patterns of regulatory focus and directing attention are similar or different in terms of satisfaction and frustration of three basic psychological needs (i.e., for autonomy, competence, and relatedness).

## Theoretical framework

### *Regulatory focus: promotion and prevention*

Human motivation involves two key tendencies. The first one, which is encapsulated in what regulatory focus theory (Higgins, 1997) termed a promotion orientation, motivates individuals to attain ideal goals, achieve aspirations, gain and develop new knowledge, and make progress (Higgins, 1997, 2012; Molden & Rosenzweig, 2016). The second tendency, which reflects a prevention focus (Higgins, 1997), motivates people to fulfil their duties/responsibilities, preserve positive and neutral states, avoid losses, and maintain safety/security (Higgins, 2012; Molden & Rosenzweig, 2016). Promotion and prevention are motivation factors that influence how people set and pursue goals; that is how they self-regulate (Cornwell et al., 2019; Higgins, 2012). Given that self-regulated learning is a special case of self-regulation (Dinsmore et al., 2008), promotion and prevention also influence students' self-regulation during learning (Hattie et al., 2020; F. A. Hodis, 2018, 2020; Molden & Rosenzweig, 2016).

Promotion is the motivation orientation characterized by strivings to attain gains and advancement and a generally eager strategic approach to goal pursuit (i.e., being willing to make errors/suffer losses in order to maximize the chances of gains; Higgins, 2012; Molden & Rosenzweig, 2016). In school settings, recent

research found that promotion was strongly and positively related to how well students expected to do in both English and mathematics (F. A. Hodis, 2018, 2020). In addition, promotion was positively related to finding efficient solutions to mathematics problems (even after accounting for prior relevant achievement and knowledge of strategies) (Wang et al., 2019).

Prevention is the motivation orientation characterized by strivings to avoid losses, maintain positive (and even neutral) states, and being driven to meet key obligations and duties (Higgins, 1997, 2012). In addition, prevention is associated with preference for using strategies that minimize the risk of errors/losses even when employment of these strategies decreases the chances for gains (i.e., vigilant strategies; Higgins, 2012; Molden & Rosenzweig, 2016). In learning settings, prevention was found to be generally unrelated (or weakly related) to both value and expectancies of success beliefs (e.g., F. A. Hodis, 2018, 2020; F. A. Hodis & Hodis, 2015). In addition, during problem solving, prevention-oriented students were more likely to choose tried-and-tested strategies (i.e., strategies they routinely used) even when they knew that more efficient alternatives exist (Wang et al., 2019).

### *Directing attention*

Attention/concentration reflects “learners’ ability to maintain their cognitive focus and to concentrate during learning” (Theobald, 2021, p. 2). In educational settings, attention serves two key functions, namely, to help select information for further processing and to direct cognitive resources towards the stimuli that are important (Chew, 2021). In this research, we focus on the latter function (i.e., directing attention) because having high levels of ability to direct attention supports learning, in general (Cermakova et al., 2010; Chon & Shin, 2019; Dinsmore et al., 2017; Hicks et al., 2021; McCrudden & McNamara, 2017; Theobald, 2021), and performance on complex cognitive tasks, in particular (Burgoyne & Engle, 2020). Notably, students’ ability to direct their attention during learning is a facet of attention control; attention control is a “domain-general ability to regulate information processing in service of goal-directed behavior” (Burgoyne & Engle, 2020, p. 624).

Recent research has found that allocating consistent attention to tasks has multiple benefits (e.g., facilitates effective information processing and task performance) and is meaningfully related to motivation (Hicks et al., 2021; Unsworth & Miller, 2021). For example, Cermakova et al. (2010) reported positive associations between attention control and deep and

strategic approaches to studying (i.e., study to advance understanding and to achieve the highest grade, respectively). In a similar vein, Chon and Shin (2019) found that directed attention was positively associated with using effective learning strategies and negatively associated with employing ineffective learning strategies. In addition, Chon and Shin (2019) reported that two groups of students had the highest levels of directed attention in the sample. In the first group, students engaged in learning because they enjoyed it or fully accepted its importance (i.e., had primarily an autonomous motivation). In the second group, students engaged in learning both because they understood its importance (which suggests strong autonomous motivation) and because they felt pressure to learn (e.g., to maintain feelings of self-worth and avoid guilt/shame – which reflects elevated controlled motivation).

Theory and empirical research suggest that there might be a link between regulatory focus and directing attention (Higgins, 1997, 2012). Specifically, people who have a strong promotion orientation devote more attention to information and stimuli that are congruent with this orientation (e.g., gains, positively-valenced information, ideals, etc.) than to information/stimuli that are neutral or incongruent with promotion. Similarly, individuals who have a strong prevention orientation devote more attention to information and stimuli that are congruent with prevention (e.g., losses, responsibilities, negatively-valenced information, etc.). Recent research has supported and extended these propositions. Martin-Garcia et al. (2023) found that effective directing of attention to affective stimuli was strengthened by a match (fit) between a participant's promotion/prevention and the context in which the presentation of the stimuli was embedded (i.e., a promotion vs. a prevention context).

Results of two experimental studies reported by Friedman and Forster (2005) indicate that people are more likely to flexibly (and appropriately) allocate attention “between multiple inputs and processing requirements” (p. 77) when they are primed with approach (vs. avoidance) cues. Notably, a promotion orientation is linked to strong preference for approaching gains and positive outcomes (e.g., rewards), whereas a prevention focus is associated with a strong tendency to avoid losses and failure. Considering these aspects, the findings reported by Friedman and Forster (2005) could be taken to suggest that appropriate directing of attention may be more likely under a promotion rather than a prevention focus. This knowledge notwithstanding, it remains unclear how it could be used

to inform predictions about the role of regulatory focus in directing attention to information that is not framed as gain- or loss-related. In addition, the existing research does not shed light on how regulatory focus orientations relate to directing attention outside the laboratory, in environments (like school settings) where both approach and avoidance tendencies are well-represented and where numerous types of stimuli and information are constantly present (e.g., information involving both gain- relevant and loss-relevant aspects as well as information pertaining to neither gains nor losses).

### *Satisfaction/frustration of basic psychological needs*

Basic psychological needs are “psychological nutrients essential for individuals’ adjustment, well-being, and psychological growth” (Vansteenkiste et al., 2023, p. 84; for an earlier definition, see Ryan & Deci, 2016). Basic Psychological Needs Theory (BPNT), which is one of the key theories of the broader self-determination theory (SDT; Ryan & Deci, 2017), proposes that all humans have three basic psychological needs, namely for autonomy (volition; willingness), competence (efficacy; mastery), and relatedness (bonding; care; Vansteenkiste et al., 2023). Moreover, BPNT proposes that satisfaction and frustration of each basic need influences people’s well- (vs. ill-) being and their ability to meaningfully engage with tasks and activities (Ryan et al., 2022; Vansteenkiste et al., 2023).

BPNT also posits that “frustration of the psychological needs involves more than a lack of fulfilment; need frustration also entails a direct threat and obstruction of the basic needs” (Vansteenkiste et al., 2023, p. 87). Research suggests that psychological need satisfaction and frustration “are empirically distinct ... and co-occur” (Vansteenkiste et al., 2023, p. 88; see also Li et al., 2020; Ryan & Deci, 2017; Warburton et al., 2020). That is, people experience (perhaps to different degrees) both satisfaction and frustration of their autonomy, competence, and relatedness. Below, we discuss in some more details these basic psychological needs. In addition, for each need in part, we highlight some implications of need satisfaction/frustration.

Autonomy involves the need to experience oneself as the driving force behind one’s behaviours (Ryan & Deci, 2017; Vansteenkiste et al., 2023). In contexts where people’s need for autonomy is supported, individuals willingly engage in tasks/activities; this is because in autonomy-supportive settings/situations, what people do/think is consistent with people’s enduring interests and values (Ryan et al., 2021;

Vansteenkiste et al., 2023). In contrast, in environments where their need for autonomy is thwarted, people feel compelled to do activities/tasks they would otherwise stay away from; unsurprisingly, task engagement in these types of settings feels conflicted/pressured and is inconsistent with people's interests and values (Ryan & Deci, 2017; Vansteenkiste et al., 2023).

Competence involves the need to feel effective in, and to influence key aspects of, goal pursuits (Ryan & Deci, 2017, 2020; Warburton et al., 2020). When individuals' need for competence is met in an environment or setting, they perceive that they are appropriately challenged and, thus, are energized to learn and advance their skills (Vansteenkiste et al., 2020). When people's need for competence is thwarted (e.g., when they perceive that they function in environments where it is difficult/impossible to exercise, express, and/or strengthen their skills), they are likely to have low perceptions of own competence, experience a sense of failure, and feel helpless (Ryan & Deci, 2017; Vansteenkiste et al., 2020, 2023).

Relatedness subsumes people's need to be cared for and feel connected to organizations, communities, or groups they value (Ryan & Deci, 2020; Vansteenkiste et al., 2020). When individuals' need for relatedness is supported, they feel securely connected to and involved with others they care about (Ryan & Deci, 2017). When their need for relatedness is frustrated, however, people feel lonely and experience social isolation (Ryan & Deci, 2017; Vansteenkiste et al., 2020, 2023). In school settings, relatedness satisfaction with teachers and peers is associated with stronger identification with school, elevated motivation, and enhanced engagement (Ryan & Deci, 2017; Vansteenkiste et al., 2023). These aspects, in turn, support the adaptive self-regulation of learning. For example, when students experience relatedness satisfaction with their teachers/instructors, students are more likely to internalize teachers' views on the importance of learning and, thus, to set beneficial learning goals. In contrast, when their relatedness is frustrated, students feel alienated and lack belongingness to, and identification with, the school. In turn, this could lead to disengagement with school and might prompt contemplating dropping out of school (especially when facing difficulties in learning, which could prompt competence and autonomy frustration as well; Ryan & Deci, 2017; Vansteenkiste et al., 2023).

Research on need satisfaction-frustration has provided consistent and unequivocal evidence that satisfaction of autonomy, competence, and relatedness leads to well-being and optimal functioning. In contrast, frustration of these needs brings about ill-being

and suboptimal functioning (Ryan & Deci, 2017; Ryan et al., 2022; Vansteenkiste et al., 2023). Therefore, when people's psychological needs are satisfied, they feel authentic and have energy and vitality; these key precursors of effective behavioural and cognitive engagement are likely to be severely diminished when individuals' needs are frustrated. Notably, directing attention is an effortful cognitive process, which is made even more taxing by the presence of distractions/temptations that abound in many students' learning environments. Hence, it is likely that need satisfaction is positively related to effective directing of attention, whereas need frustration is negatively associated with effective directing of attention.

### *Interrelationships among need satisfaction/frustration and promotion/prevention*

Vaughn (2017) found that when people remembered experiences that focused on hopes and aspirations (that is, when they remembered promotion-focused experiences) they had higher perceptions of basic psychological needs support than when they recalled experiences that focused on fulfilling duties/obligations (i.e., prevention experiences). Consistent findings were reported by Wang et al. (2017). In the same vein, G. M. Hodis and Hodis (2021) found generally strong positive (negative) interrelationships between promotion and satisfaction (frustration) of autonomy, competence, and relatedness. In their study, prevention had a statistically significant negative association with competence satisfaction; two other negative associations of prevention (i.e., with autonomy frustration and relatedness frustration) approached but did not reach statistical significance. Prevention's relationships with autonomy satisfaction, relatedness satisfaction, and competence frustration were weak and not statistically significant.

Vaughn (2017) also found that respondents interpreted experiences that were high (low) in needs support as being promotion- (prevention-) focused. Vaughn argued that the reciprocal relationship between regulatory focus and support for basic psychological needs can be attributed to the fact that both types of factors "pertain to judgments about how well things seem to be going" (2017, p. 326). In all, Vaughn's (2017) research provided indications that the level of promotion/prevention might influence perceptions of needs satisfaction and, vice-versa, that the extent of needs satisfaction may influence the level of promotion/prevention. We are not aware of any study that examined the directionality of the interrelationships between regulatory focus and needs frustration.

The corpus of findings we overviewed above suggests that a promotion orientation's focus on ideals and aspirations is consistent with satisfaction of all three basic psychological needs. This is because the pursuit of one's ideals and aspirations is authentic, autonomously motivated (e.g., "I want to"), conducive to enhancing the skills and abilities needed to close the gap between the current and the ideal state, and shared with (or supported by) significant people and/or groups. In contrast, although the motivation to fulfil duties and obligations could be well-internalized, it is often not. When this internalization is weak, people are driven by a controlled motivation (e.g., "I don't want to but I have to"), where the focus is on achieving the required outcomes and not on the development of skills/abilities that facilitate the attainment of these end-states. Moreover, social engagements/relationships that are driven by the external expectations placed on the individual might feel unauthentic/pushed; consequently, relatedness is likely to suffer.

From a conceptual standpoint, it is useful to consider how regulatory focus orientations relate to both need satisfaction *and* need frustration because need frustration is conceptually distinct from lack of need satisfaction (Li et al., 2020; Ryan & Deci, 2017; Vansteenkiste et al., 2023; Warburton et al., 2020). Hence, knowledge of the associations between promotion-prevention and need satisfaction provides insufficient/incomplete information on how regulatory foci are related to need frustration. From a practical standpoint, in education settings, teachers/instructors enact (often during the same lecture/class) both behaviours that supports their students' need satisfaction and behaviours that thwart students' needs (Ahmadi et al., 2023). Considering that promotion-prevention and need satisfaction-frustration frameworks provide different lenses to understand motivation, mapping the relations between regulatory focus orientations and need frustration could be beneficial for both instruction and intervention research and practice. For example, interventionists may capitalize on the strong negative association between promotion and need frustration (e.g., G. M. Hodis & Hodis, 2021) to implement initiatives that heighten teachers' promotion focus to orient them towards positive outcomes and, thus, reduce reliance on behaviours that thwart students' psychological needs (e.g., sarcastic remarks when facing off-task student behaviour).

## Objectives

The first objective of this study was to map how three factors that are influential in self-regulation and

learning are organized within individuals. Both regulatory focus orientations (i.e., promotion and prevention foci) and effective directing of attention to learning tasks are critical to successful learning (Cermakova et al., 2010; Dinsmore et al., 2017; Hicks et al., 2021; F. A. Hodis, 2018, 2020; McCrudden & McNamara, 2017). In addition, promotion and prevention are likely to be related to how people direct their attention (Friedman & Forster, 2005; Martin-Garcia et al., 2023). These aspects notwithstanding, it is currently unknown how students' promotion and prevention interact with how they direct attention during learning. Thus, in this research, we examined whether there are distinct combinations (i.e., profiles) of promotion, prevention, and directing attention. To shed light on this aspect, we conducted a latent profile analysis and investigated whether different unobserved patterns (combinations; configurations) of promotion, prevention, and directing attention can be identified.

Existing research has provided ample evidence that the degree to which students' psychological needs for autonomy, competence, and relatedness are satisfied/frustrated influences their engagement with, and persistence in, learning (Ryan & Deci, 2017, 2020; Ryan et al., 2022; Vansteenkiste et al., 2020, 2023). However, it is currently unknown the extent to which the strengths of the need satisfaction/frustration factors might be similar/different across subgroups defined by distinct combinations of regulatory focus and directing attention. Thus, a second objective of this study was to examine whether adaptive promotion-prevention-directing attention configurations are associated with higher levels of need satisfaction and lower levels of need frustration than less adaptive combinations of regulatory foci and directing attention. To attain this objective, we assessed the extent to which unobserved groups characterized by distinct regulatory focus – directing attention configurations significantly differed with regard to autonomy satisfaction/frustration, competence satisfaction/frustration, and relatedness satisfaction/frustration.

## Method

### Participants

Respondents were 307 students (mean age = 20.46;  $SD = 3.23$ ) who were enrolled in several sections of communication and kinesiology courses at a mid-size public university in the United States. More participants self-identified as males than females (175 vs. 129); two respondents self-identified as other, and

one did not record this information. A similar number of seniors (90), juniors (81), and first-year students (78) took part in the study; the number of respondents who self-identified as sophomores was smaller (58). The study did not collect data on participants' ethnicity or socio-economic status.

### Measures

Students rated the items used in this study on a 1–7 Likert scale, where 1 corresponded to “Strongly disagree” and 7 to “Strongly agree”. The items were taken/adapted from scales with appropriate validity and reliability. Specifically, the first two indicators used in the latent profile analyses, that is, promotion (6 items) (e.g., “Compared to most people, I am typically able to get what I want out of life”) and prevention (5 items) (e.g., “As a child, I often obeyed rules and regulations that were established by my parents”), were gauged with the RFQ (i.e., Regulatory Focus Questionnaire; Higgins et al., 2001). Findings from past research suggest that the RFQ provided valid and reliable scores for these constructs (e.g., Higgins et al., 2001; F. A. Hodis, 2017, 2018, 2020; F. A. Hodis & Hodis, 2015, 2017). In our study, the reliability for promotion was  $\alpha = .80$ ; for prevention,  $\alpha = .79$ . The third profile indicator (i.e., directing attention) was gauged with four items (e.g., “When I have trouble understanding in the course, I focus harder on what I study”) adapted from the directed attention subscale of the metacognitive awareness listening questionnaire (MALQ; Vandergrift et al., 2006). Several research studies found that this subscale appropriately measured this construct (e.g., Chon & Shin, 2019; Vandergrift et al., 2006). The reliability for directing attention in the present research was  $\alpha = .68$ .

The six dimensions of basic psychological need satisfaction/frustration were measured with the corresponding subscales developed by Chen et al. (2015); each subscale included four items. The Cronbach's alpha values for these factors were .67 for autonomy satisfaction (e.g., “I feel a sense of choice and freedom in the things I do”), .72 for autonomy frustration (e.g., “I feel pressured to do too many things”), .83 for competence satisfaction (e.g., “I feel competent to achieve my goals”), .81 for competence frustration (e.g., “I feel insecure about my abilities”), .86 for relatedness satisfaction (e.g., “I feel connected with people who care for me, and for whom I care”), and .74 for relatedness frustration (e.g., “I feel that people who are important to me are cold and distant towards me”).

### Procedure

Prior to the start of the data collection, the study received ethics approval from the Human Ethics committee of Southern Illinois University (Protocol Number 19,175). Data were collected using paper and pencil questionnaires (self-reports) administered during class time to students who were enrolled in several sections of communication and kinesiology courses. The surveys were administered by the instructor teaching each specific section. These instructors presented the research and explained that participation in the study was voluntary. Students who took part in this research provided informed consent and received no monetary compensation for their participation in the study. The surveys contained no personal information whatsoever; completed surveys were gathered in an empty envelope that was passed on to the research team.

### Analysis plan

This research used latent profile analysis (LPA) because unlike variable-centred strategies (e.g., multiple regression), LPA is well-suited to identify latent (i.e., unobserved) classes; that is, groups defined by different combinations (configurations, or patterns) of promotion, prevention, and directing attention (Harring & Hodis, 2016; Peugh & Fan, 2013; Tein et al., 2013). In addition, LPA is also able to facilitate comparisons among these classes with regard to key factors of interest, while accounting for the probabilistic nature of the classification in latent classes (Harring & Hodis, 2016; Peugh & Fan, 2013; Tein et al., 2013). LPA involves two key phases: In Phase 1, the researchers determine the number of classes (groups; profiles). In Phase 2, they describe the configurations of these classes (i.e., the patterns of absolute and relative strengths of promotion, prevention, and directing attention) and examine similarities/differences among classes/profiles with regard to the needs satisfaction and frustration factors. The online supplement (OS) provides more details on LPA.

### Results

#### Identifying the number of classes

All the LPAs conducted in this study used as profile indicators the average scores on promotion, prevention, and directing attention items, respectively. The last row in Table 2 includes descriptive statistics for these indicators. The very small values of skew/kurtosis for promotion (−0.32/−0.10), prevention (−0.41/−0.26), and directing attention (−0.21/−0.27) suggest that the

**Table 1.** Information used to identify the number of classes.

Model	SSS	LL	AIC	BIC	SABIC	<i>p</i> -ALRT	<i>p</i> -BLRT	Entropy
1-class	–	–1329.55	2671.10	2693.46	2674.43	–	–	–
2-class	151	–1290.55	2607.09	<b>2655.54</b>	2614.31	<.01	<b>&lt;.01</b>	.534
3-class	87	–1275.90	2591.81	2666.35	2602.91	<b>.04</b>	.25	.648
4-class	12	–1263.46	2580.92	2681.55	2595.91	.18	.53	.770
5-class	12	–1254.38	2576.76	2703.48	2595.64	.22	.82	.741

SSS = the number of participants classified in the smallest class of the model; LL = log-likelihood. Bold values indicate that the information criterion or test suggests retaining the model with the given number of classes.

**Table 2.** Descriptive statistics for latent classes and the entire sample.

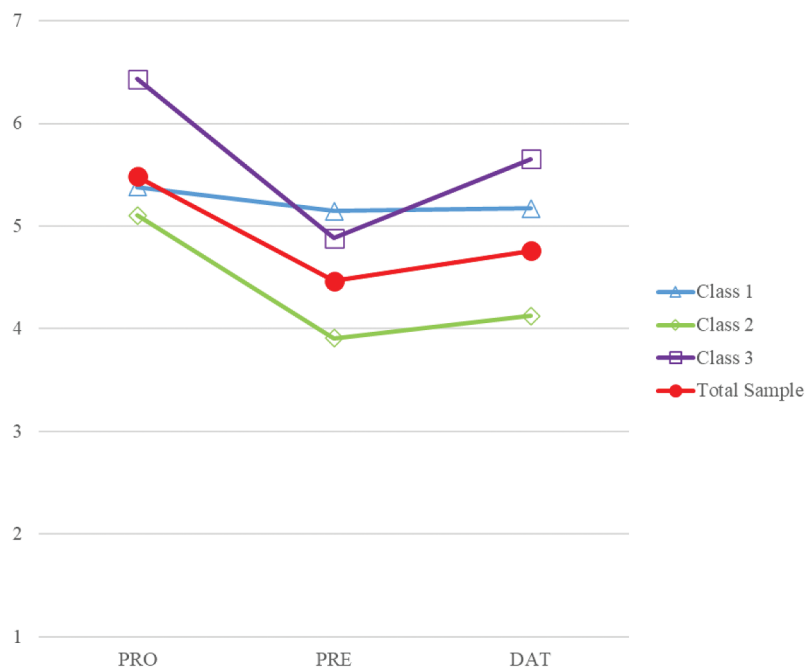
Class	%	N	PRO			PRE			DAT		
			M	SE	CI	M	SE	CI	M	SE	CI
C1	28.34	87	5.38	0.09	(5.20, 5.56)	5.15	0.22	(4.72, 5.58)	5.17	0.13	(4.92, 5.42)
C2	49.51	152	5.10	0.10	(4.90, 5.30)	3.91	0.14	(3.64, 4.18)	4.12	0.14	(3.85, 4.39)
C3	22.15	68	6.43	0.14	(6.16, 6.70)	4.88	0.24	(4.41, 5.35)	5.65	0.16	(5.34, 5.96)
Tot	100	307	5.49	0.05	(5.39, 5.59)	4.46	0.07	(4.32, 4.60)	4.76	0.06	(4.64, 4.88)

PRO = promotion; PRE = prevention; DAT – Directing attention; M = Mean; SE = standard error; CI = 95% confidence interval; C = class; Tot = total sample.

multivariate normality assumption was not violated (Curran et al., 1996).

All data were analysed with Mplus, version 8.2 (Muthén & Muthén, 2010), by using FIML (Arbuckle, 1996) with a robust estimator (MLR; Muthén & Muthén, 2010). As noted in the OS, determining the number of latent classes involved considering information provided by several statistical indexes. Results in Table 1 indicate that the values for AIC and SABIC decreased as the number of latent classes extracted increased; hence, these indexes did not provide useful information for this analysis. In contrast, BIC and B-LRT favoured retaining two classes, whereas ALRT supported a model with three classes.

Subsequently, the two models supported by these statistical indexes were examined in more depth. This examination revealed that the 3-class model included a conceptually meaningful latent class that was missed in the 2-class model, namely a class where the mean values of promotion and prevention were similar. In the same vein, in both classes of the 2-class model, mean scores of directing attention were higher than the corresponding prevention scores. This was not the case for the model with three classes; in this model, the average values of directing attention and prevention were similar in one latent class. Taken together, these aspects suggest that the model with two classes misses a meaningful class, in which the strengths of profile

**Figure 1.** Latent profiles. PRO = Promotion; PRE = Prevention; DAT = Directing attention.

indicators are comparable. In addition, an examination of the classification probabilities for the most likely latent class membership in the 3-class model indicates that these probabilities exceeded .80 for each latent class; this suggests a low likelihood of misclassification of students to latent classes. Moreover, both the model with four classes and the model with five classes included a very small class ( $n = 12$  in both cases; see Table 1). Retaining models involving small classes is not optimal, not least because these small sample sizes render comparisons across classes problematic. Considering all these aspects, we adopted the 3-class model. The configurations (profiles) that correspond to these three classes are illustrated in Figure 1; the descriptive statistics for the profile indicators for each class are reported in Table 2. Below, we briefly describe the characteristics of each latent class.

Class 1 (i.e., C1) comprised 28.34% of the sample (i.e., 87 respondents). Students classified in C1 had similar average values of the three indicators. Class 2 (i.e., C2), which was the largest of the three classes, included 49.51% of the sample (i.e., 152 participants). Compared to C1, C2 had somewhat lower mean values of promotion and much lower values of both prevention and directing attention. In C2, the mean of promotion was higher than the mean of the other indicators, which had comparable values. Class 3 (i.e., C3), which included 22.15% of the sample (i.e., 68 respondents) had higher average values of promotion and directing attention and slightly lower mean values of prevention than C1. In C3, promotion was (on average) stronger than directing attention which, in turn, was higher than prevention.

### **Comparisons among the three latent classes with regard to the basic psychological need satisfaction/frustration factors**

In Phase 2 of LPA we examined whether the three latent classes uncovered significantly differed with regard to the six need satisfaction and frustration factors. To do so, for each factor, we used the AUXILIARY (BCH) option of the VARIABLE command

in Mplus (Asparouhov & Muthén, 2014, 2020). Methodological research suggests that the BCH is a valid strategy for investigating mean differences in factors across latent classes (Asparouhov & Muthén, 2014, 2020; Bakk et al., 2013). The results of the tests for the six factors are reported in Table 3 and illustrated in Figure 2.

Results in Table 3 indicate that average values for autonomy and relatedness satisfaction were significantly higher in C3 than in C1 and in C1 than in C2. For competence satisfaction, C3 had a significantly higher mean value than C1 and C2; the difference between C1 and C2 was not statistically significant. With regard to basic need frustration, results for the autonomy factor indicate that both C1 and C3 had significantly lower mean values than C2; C1 and C3 did not significantly differ. For competence frustration, the average value in C3 was significantly lower than the corresponding values in C1 and C2; the latter means did not significantly differ. Finally, for relatedness frustration, the mean value in C3 was significantly lower than the mean values in C1 and C2, with C1 also being significantly smaller than C2. Of note, very similar results were obtained when an alternative to the BCH method (i.e., DU3STEP) was used.

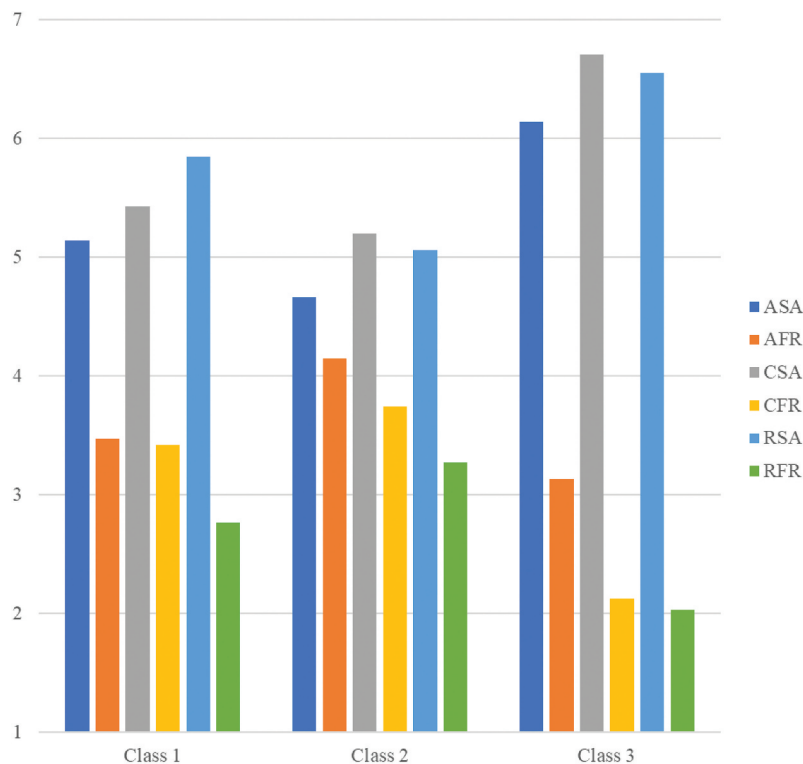
## **Discussion**

This research had two objectives. The first was to identify the classes/configurations that map the associations among promotion, prevention, and directing attention. Regarding this aim, the results reported in this research suggest that three unobserved classes underpin the relationships among regulatory focus orientations and directing attention. Class 1 (C1) was characterized by similar mean levels of promotion, prevention, and directing attention. On a descriptive level, the mean level of prevention in C1 was the highest of all classes identified in this study. Compared to their respective sample values, promotion was of average magnitude, whereas prevention and directing attention were strong and above average, respectively.

**Table 3.** Tests statistics of mean differences among classes in satisfaction and frustration of basic psychological need factors.

Latent Class	ASA		AFR		CSA		CFR		RSA		RFR	
	M	SE	M	SE	M	SE	M	SE	M	SE	M	SE
Class 1	5.14 <sup>a</sup>	0.12	3.47 <sup>a</sup>	0.15	5.43 <sup>a</sup>	0.10	3.42 <sup>a</sup>	0.16	5.84 <sup>a</sup>	0.12	2.77 <sup>a</sup>	0.15
Class 2	4.66 <sup>b</sup>	0.09	4.15 <sup>b</sup>	0.11	5.20 <sup>a</sup>	0.09	3.75 <sup>a</sup>	0.12	5.06 <sup>b</sup>	0.11	3.28 <sup>b</sup>	0.13
Class 3	6.14 <sup>c</sup>	0.11	3.13 <sup>a</sup>	0.19	6.70 <sup>b</sup>	0.09	2.13 <sup>b</sup>	0.18	6.55 <sup>c</sup>	0.10	2.03 <sup>c</sup>	0.13
Total	5.13	0.92	3.73	1.47	5.61	0.86	3.29	1.66	5.61	1.12	2.85	1.43

ASA = Autonomy satisfaction; AFR = Autonomy frustration; CSA = competence satisfaction; CFR = Competence frustration; RSA = relatedness satisfaction; RFR = Relatedness frustration; Variances (not standard errors) are reported for the total sample; In a column, when two or more values share a superscript, this indicates that for the given factor the corresponding classes do not significantly differ at  $\alpha = .05$ .



**Figure 2.** Similarities and differences among the four latent classes with regard to satisfaction and frustration of basic psychological need ASA = autonomy satisfaction; AFR = autonomy frustration; CSA = competence satisfaction; CFR = competence frustration; RSA = relatedness satisfaction; RFR = relatedness frustration.

Thus, the C1 profile could be labelled as “balanced with strong prevention”.

Class 2 (C2) had the lowest average levels of promotion, prevention, and directing attention of all classes. In C2, promotion was stronger than both prevention and directing attention; the latter profile indicators were lower than their respective sample means and had similar magnitudes. The C2 profile could be considered as having “weak indicators”. Class 3 (C3) had the highest levels of promotion and directing attention and the second highest prevention of all three classes. In C3, the mean value of each profile indicator was higher than its sample counterpart. In this class, promotion was stronger than directing attention, which was stronger than prevention. Thus, the C3 profile could be labelled as having “strong indicators”.

The second objective of this research was to examine whether these three classes are similar/different in terms of satisfaction and frustration of basic psychological needs. About this objective, results indicate that students classified in the latent class characterized by the highest average levels of both promotion and directing attention (i.e., C3; the “strong indicators” profile) had the most optimal pattern of needs satisfaction and frustration of all classes. Specifically, students in C3 had, on average,

higher levels of autonomy, competence, and relatedness satisfaction as well as lower levels of autonomy, competence, and relatedness frustration than students in the other two classes; not all of these differences were statistically significant, however. In contrast, students classified in the class characterized by the lowest levels of promotion and directing attention (i.e., C2; the “weak indicators” profile) had a suboptimal pattern of needs satisfaction/frustration. In particular, students in C2 had the lowest mean levels of all needs satisfaction factors and the highest levels of all needs frustration factors; some of the differences involving C2 were not statistically significant.

Results from this study indicate that students who had high satisfaction and low frustration of psychological needs also had strong promotion orientations. These findings, which were facilitated by a person-centred data analytic strategy (i.e., latent profile analysis), are in line with results of recent studies that used variable-centred data analytic techniques (e.g., path analysis; G. M. Hodis & Hodis, 2021; ANOVA; Vaughn, 2017). This consistency of findings across samples and analytic approaches bodes well for their generalization. In addition, results in our study indicate that when students’ basic needs are unmet/frustrated,

promotion, prevention, and directing attention are likely to be relatively low (see the C2, “weak indicators” profile). These findings suggest that when students learn in environments that do not provide appropriate support for the satisfaction of their basic psychological needs or even thwart them, they are unlikely to strive to develop/progress their knowledge, to be motivated to fulfill learning-related duties/responsibilities, and to appropriately direct their attention during studying. Hence, they may become amotivated and disengage from school (Ryan & Deci, 2017; Ryan et al., 2022; Vansteenkiste et al., 2023).

Findings from this research are in line with theorizing that satisfaction and frustration of basic psychological needs are key predictors of self-regulation and motivation (Ryan & Deci, 2017; Ryan et al., 2022). Specifically, we found that students who had high levels of satisfaction of relatedness, competence, and autonomy, and low levels of frustration of these needs also had the most adaptive pattern of regulatory focus and directing attention (see the C3, “strong indicators” profile). In contrast, students who had low satisfaction and high frustration of these needs, also had low levels of regulatory foci and the lowest level of directing attention (see the C2, “weak indicators” profile).

The ability to effectively direct attention during learning is a key contributor to learning and achievement in educational settings (Cermakova et al., 2010; Chon & Shin, 2019; Weinstein & Sumeracki, 2019). However, Theobald (2021) cautioned that regulating attention is not always easy and, thus, may have to be supported in learning environments. Of note, findings from a recent meta-analysis (Theobald, 2021) indicate that the ability to direct attention can be improved by training/interventions. Results from our study suggest two ways in which appropriate directing of attention could be supported in learning settings.

First, research guided by self-determination theory has provided strong evidence that people’s satisfaction/frustration of basic needs is malleable (Ryan & Deci, 2017; Ryan et al., 2022). Moreover, how instruction is set up and how teachers interact with learners, affect students’ needs satisfaction and frustration (e.g., Baker & Goodboy, 2018; Goldman & Brann, 2016; Ryan & Deci, 2017). Adding the findings of our study to this corpus of research suggests that a potentially productive avenue for supporting students’ ability to effectively direct their attention in learning settings is to enhance their need satisfaction and reduce their need frustration in these settings (Ryan & Deci, 2017). For example, as both our research and other studies have found strong links between higher promotion and increased (decreased) needs satisfaction (frustration)

(e.g., G. M. Hodis & Hodis, 2021), strengthening promotion might enhance needs satisfaction, decrease needs frustration, and support ability to appropriately direct attention during studying; for other research-based strategies to productively alter needs satisfaction and frustration, see the section on Practical Implications.

Second, this research found that the highest levels of directing attention corresponded to the latent classes where promotion was quite strong (i.e., C3 and C1). However, this was not the case for prevention: although the average level of prevention was higher in C1 than in C3, directing attention was, on average, *lower* in C1 than in C3. This pattern of findings is consistent with Heitmann et al. (2022) argument that when students are motivated to approach success, they have more cognitive capacity than when they are motivated to avoid failure. Considering that promotion is more strongly associated with motivation to approach success than with motivation to avoid failure and that the vice-versa is true for prevention (Higgins, 1997, 2012), our findings suggest that when students engage in learning with a promotion focus, they might be better able to direct their attention than when they complete learning tasks with a prevention focus. We highlight research evidence that is consistent with this hypothesis in the final part of this section.

When their promotion is strong, individuals generate and evaluate numerous alternative explanations/hypotheses and engage in rapid and flexible information processing (Higgins, 2012; Miele & Wigfield, 2014; Naletelich & Spears, 2020; Petrou et al., 2020; Zhu & Meyers-Levy, 2007). In contrast, when their prevention is strong, people generate and evaluate few alternative explanations/hypotheses and engage in thorough and relatively slow processing of information (Higgins, 2012; Miele & Wigfield, 2014; Naletelich & Spears, 2020; Petrou et al., 2020; Zhu & Meyers-Levy, 2007). In addition, when working on a task with a promotion focus, people are less likely to be vigilant about what they do or feel anxious about their performance on the task (compared to when they do the same task with a prevention focus; Higgins, 2012). In turn, anxiety is generally associated with strains on cognition (e.g., reduced working memory capacity; Lourenco & Liu, 2023) and “vigilance is effortful and stressful” (Vaughn et al., 2021, p. 10; for a similar stance, see also Warm et al., 2008). Moreover, as promotion often reflects an approach motivation, it is also likely to be associated with focused attention on task-related goals; this type of attention is positively related to working memory capacity. In contrast, prevention generally reflects an avoidance orientation and, thus, might be “typically accompanied by attention that is

primarily stimulus-driven” (Lourenco & Liu, 2023, p. 4); this kind of attention is likely to be negatively related to working memory capacity (Lourenco & Liu, 2023). Taken together, this corpus of research suggests that when students are promotion (vs. prevention) oriented during learning, they may have more cognitive capacity to appropriately (re)direct their attention to effectively support their learning. Future research would do well to examine this hypothesis.

### Limitations and future directions of research

Although findings from this research are noteworthy, they are not free of limitations. Overcoming these limitations provides a launching pad for potentially productive future research. First, this study investigated only two motivation factors that are critical for self-regulation (i.e., promotion and prevention). To overcome this limitation, future studies could consider other motivation factors that influence self-regulation. For example, research informed by regulatory mode theory (Higgins, 2012; Pierro et al., 2018) indicates that assessment and locomotion influence the extent to which people prefer to engage in immediate action or undertake in-depth comparative analyses, respectively. To our knowledge, it is currently unknown how patterns of assessment, locomotion, prevention, and promotion relate to the ability to direct attention. Moreover, it is also unclear whether distinct combinations of regulatory focus and mode are underpinned by differential patterns of need satisfaction and frustration. Future work could investigate these aspects.

Second, although in learning environments attention serves two key roles (i.e., to appropriately direct cognitive resources and select information for further processing, respectively; Chew, 2021), this research investigated only the former. Future studies could overcome this limitation by examining profiles of motivation and attention that canvass both roles of attention. Third, students who participated in this research had a relatively narrow range of ages, which did not enable testing whether the interrelationships examined are (vs. are not) consistent across different developmental stages. Thus, future research could collect data from samples having a much wider range of ages and examine whether similar (vs. different) profiles of motivation-attention are identified across developmental stages (e.g., for high school students and middle-age adults). Given that a recent review of meta-analytic findings of major aspects informed by self-determination theory found mixed results about the potentially moderating role of age (Ryan et al., 2022), this kind of future research could be productive.

Fourth, the data available for this study do not afford making causal inferences. Moreover, we are not aware of any published study that investigated the directionality of the interrelationships between regulatory focus and needs frustration. Hence, we do not know (a) whether having different levels of basic needs satisfaction and frustration *causes* different configurations of promotion, prevention, and directing attention; and/or (b) whether different profiles of regulatory focus and directing attention lead to different patterns of needs satisfaction and frustration. To overcome this challenge – and further advance understanding of these key aspects – future studies could, for example, experimentally assign participants to different conditions of basic needs satisfaction/frustration and examine whether these conditions lead to significant differences in promotion, prevention, and directing attention.

Fifth, this study collected data from a single culture (i.e., the USA, which is a Western culture). To examine whether the profiles of promotion, prevention, and directing attention identified in this research generalize, future research could collect data from other cultures (e.g., China, which is an Eastern culture). Finally, future research could build upon the findings in our study by harnessing the power and versatility of latent profile analyses to propose and examine more complex LPA models involving both predictors of latent class membership and a host of pertinent outcomes; see Bakk et al. (2013), Bakk et al. (2016), and Asparouhov and Muthén (2014) for methodological information pertaining to these more complex LPA models.

### Practical implications

Results from our study, which are consistent with both conceptual tenets of, and key empirical findings informed by, SDT (see Ryan & Deci, 2017; Ryan et al., 2022 for extensive summaries and discussions), suggest that university students’ regulatory focus orientations and ability to appropriately direct attention during study are likely to be stronger when they function in environments that support the satisfaction of their basic needs and limit/eliminate their frustration. In these types of settings/environments, students are likely to eagerly pursue their aspirations, want to advance their knowledge while being mindful of their responsibilities, and appropriately direct their attention while studying. In contrast, learning environments where students have low satisfaction and high frustration of their psychological needs are likely to be associated with lower student motivation to advance their

understanding, weak preoccupation to undertake learning tasks, and reduced ability to focus attention.

A recent review of meta-analytic results of SDT (i.e., Ryan et al., 2022) suggests that satisfaction and frustration of basic psychological needs could be productively altered by means of two types of strategies. First, institutions could develop policies and/or initiatives so that teaching prioritizes students' autonomy during learning, facilitates constant skill development, and supports the development of appropriate and meaningful connections among students and between students and their lecturers. Second, improvements in (i) students' awareness of their basic psychological needs (and of how different contexts/settings contribute to them) and (ii) their ability to regulate emotions and manage motivation during studying are also likely to strengthen their needs satisfaction and reduce/eliminate needs frustration (Ryan et al., 2022). For example, when students are aware of the key significance of basic needs satisfaction and understand how settings and environments influence needs satisfaction, they could identify tasks/contexts that support their needs and engage with them (Vansteenkiste et al., 2023). This "need crafting involves optimization and maximization of basic needs through selection of need-satisfying activities and contexts" (Vansteenkiste et al., 2023, p. 109). To reduce needs frustration, students could, for example, engage in self-talk that helps them reframe the way they construe tasks or activities from need-thwarting to need-satisfying; for further discussions, see Vansteenkiste et al. (2023).

## Conclusion

This research uncovered three distinct configurations (profiles) of motivation and cognitive factors in a sample of undergraduate students. These different profiles were associated with significant differences in students' need satisfaction and frustration. Of the three configurations identified in this research, the profile reflecting high promotion, relatively high prevention, and high ability to direct attention (which was also associated with strong needs satisfaction and weak needs frustration) appears to be the most adaptive. The findings of our research provide further support for theoretical and empirical accounts of the interrelationships among regulatory focus and needs satisfaction/frustration (G. M. Hodis & Hodis, 2021; Vaughn, 2017; Wang et al., 2017). In addition, the findings highlight the intertwined nature of motivational and cognitive processes (Higgins, 2012) and expand knowledge of the motivational and cognitive factors

associated with satisfaction and frustration of basic psychological needs.

## Disclosure statement

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## Data availability statement

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

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