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Latent profiles of achievement goal-complexes: their relationship with students' behavioral and agentic engagement

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Abstract

This prospective study used latent profile analysis (LPA) to explore the reasons underlying mastery-approach (MAp) and performance-approach (PAp) goals, examining their relationship with students' and teachers' reports on students' behavioral and agentic engagement in mathematics. Participants were 395 Peruvian high school students. Five goal-complex profiles emerged for each goal. Latent profile analysis identified five distinct motivational profiles for each goal type, revealing that most students endorsed goals for both autonomous and controlled reasons. Students in profiles characterized by high autonomous reasons had increased student-reported engagement, whereas those in profiles characterized by low autonomous reasons had reduced engagement, regardless of controlled motivation. Conversely, teacher-reported engagement was higher in profiles characterized by low controlled reasons, and lower in those with high controlled reasons, regardless of students' autonomous motivation. This person-centered approach provides nuanced insights into how combinations of autonomous and controlled reasons underlying MAp and PAp goals are endorsed by subgroups of students and how they relate to students' behavioral and agentic engagement.

Introduction

In the past decade, a growing body of research has used the goal-complex model of achievement goals (Sommet et al., 2021; Vansteenkiste et al., 2014) to explore the combined effects of achievement goals and their underlying reasons on learning outcomes (Benita et al., 2022; Gaudreau, 2012; Gillet et al., 2017; Senko & Tropiano, 2016; Sommet & Elliot, 2017). This line of research, which typically incorporates concepts from self-determination theory (SDT; Ryan & Deci, 2017) into achievement goal theory (Elliot & Thrash, 2001), has addressed several of the limitations of previous achievement goal models, the goal orientation model and the goal standards model (Senko & Tropiano, 2016).

In our study, we extended this line of research by using a person-centered approach, latent profile analysis (LPA). LPA can provide insight into issues that cannot be explored with variable-centered approaches, for example, which goal-reason configurations naturally occur among students, how often these configurations occur, and how each profile impacts learning outcomes. To explore these questions, we conducted a prospective study among secondary school students in Lima, Peru.

Achievement goal theory: from goal orientations to goal standards

In recent decades, achievement goal theory has been one of the most influential frameworks in research on students' motivation (for recent reviews, see Senko, 2016; Urdan & Kaplan, 2020). In the theory's first versions (Ames & Archer, 1988; Dweck, 1986; Maehr, 1984; Nicholls, 1984), also known as *goal orientation* models (Senko, 2016; Senko & Tropiano, 2016), the term 'achievement goal' referred to a broad orientation towards competence, or the purpose for engaging in a learning task. Researchers identified two types of goal orientations among students: some students seek to acquire new knowledge and develop competence because they seek personal growth and self-development, while others try to outperform their peers to demonstrate competence and show they are smart. They labeled these orientations mastery goals and performance goals, respectively.

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Elliot and Thrash (2001) criticized goal orientation models for lacking clear and precise definitions of goals. These authors argued a broad definition of goals as general orientations encompasses two distinct aspects of motivated behavior: its direction, manifested by the aim of the behavior, and its energization, manifested by the reason for the behavior. Instead, they favored a narrow definition of goals that defines them solely as the direction of motivated behavior, a future-oriented standard of competence. In this definition, mastery goals represent either an intrapersonal (the aim of improving one's knowledge) or an absolute (the aim of mastering the material) standard, whereas performance goals represent a normative standard of competence (the aim of outperforming other students).[1] Therefore, this model was termed the *goal standards* model (Senko, 2016; Senko & Tropiano, 2016).

Furthermore, according to this model, a goal can be endorsed with either an approach valence, defined as desirable outcomes people strive to achieve, or an avoidance valence, defined as negative outcomes they aim to avoid (Elliot & McGregor, 2001). In this research we focused solely on approach goals: mastery-approach goals and performance-approach goals. Henceforth, we will use the abbreviations 'MAp goals' to denote 'mastery-approach goals' and 'PAp goals' to denote 'performance-approach goals,' even when considering findings from a goal orientation standpoint.

Research anchored in both models shows MAp goals predict optimal learning outcomes. These goals have consistently been related to outcomes such as deep learning strategies, self-efficacy, optimal engagement, well-being, and persistence in the face of difficulty (e.g., Benita et al., 2014; Elliot & Murayama, 2008; Gutman, 2006; Matos et al., 2017; Meece et al., 1988; Wolters, 2004), but not necessarily to academic achievements (Harackiewicz et al., 2002; Hulleman et al., 2010).

However, the models diverge in showing the effects of PAp goals. Research using goal orientation models shows PAp goals are more detrimental than research using the goal standards model. For example, Hulleman et al.'s (2010) meta-analysis revealed PAp goals that include an 'appearance' component (a goal orientation approach) predict low academic achievements whereas those defined solely as normative goals (a goal standards approach) predict academic gains. In a more recent meta-analysis, Senko and Dawson (2017) extended Hulleman et al.'s findings and showed PAp goals defined as orientations predict detrimental academic outcomes, such as self-handicapping, help-avoidance, increased anxiety, and negative affect. In contrast, PAp goals defined as standards predict both adaptive outcomes (self-regulation, adaptive learning strategies, enjoyment, and positive affect) and less adaptive outcomes (anxiety and negative affect more generally).

A goal-complex model of achievement goals

As mentioned above, one advantage of the goal standards model over goal orientation models is its clarity and parsimony. This model clarifies that if a goal predicts learning outcomes, it is solely because of the direction it gives to behavior. Meanwhile, the goal standards model does not overlook the reasons underlying goal pursuit, which, in traditional goal orientation models, were treated as an inherent aspect of the goal. According to Elliot and Thrash (2001), the reasons underlying the goals are distinct and distal predictors of behavior, whereas the goals themselves are proximal predictors. This separation of goals and reasons led to the development of a third approach to achievement goals - the goal-complex model (Senko & Tropiano, 2016; Sommet et al., 2021; Vansteenkiste et al., 2014). A goal-complex is a specific combination of goals and reasons. In a goal-complex, a given goal can be endorsed for several reasons, even opposing ones. Thus, in a goal-complex approach, both MAp and PAp goals can be endorsed for distinct reasons.

To explore the reasons underlying goals, most research has employed SDT's (Ryan & Deci, 2017) distinction between autonomous and controlled reasons for goal pursuit. Goals adopted for autonomous reasons are fully endorsed, and people act on them volitionally because they find it useful or important. Goals adopted for controlled reasons are experienced as externally imposed by socialization agents (e.g., parents, teachers), pursued to please those agents, and driven by feelings such as guilt or shame. As such, autonomous reasons provide goals with an optimal energy source, enabling those who hold them to go through a smooth and uninhibited goal pursuit process (Werner et al., 2016), while controlled reasons produce conflict over a goal and limit the amount of energy available for its pursuit (Benita et al., 2023; Moller et al., 2006; Ryan & Deci, 2008).

The goal-complex model (Senko & Tropiano, 2016; Sommet et al., 2021; Vansteenkiste et al., 2014) has several advantages. First, it broadens the scope of the theory beyond a dichotomous approach. Specifically, according to goal orientation models, only two goal-reason configurations (i.e., goal-complexes) can exist: autonomous reasons-MAp and controlled reasons-PAp goals. In a goal-complex approach, however, two other goal-complexes are theoretically likely: controlled reasons-MAp goals and autonomous reasons-PAp goals. Furthermore, while this model adheres to the

[1] Elliot et al. (2011) further divided mastery goals into task goals, reflecting an absolute standard, and self-goals, reflecting an intrapersonal standard. We adopted this measure, but for simplicity and because this distinction was not central to our research questions, we combined them into a single category of mastery goals.

rigor and simplicity of the goal standards model, it enables a nuanced and enriched achievement goal framework, capturing several aspects of motivated behavior.

Research espousing the goal-complex model is increasing (for a recent review, see Sommet et al., 2021). Such research has used three complementary approaches to study the combined effects of achievement goals and their underlying reasons on learning outcomes. The first is to explore the additive effect of goals and reasons, thus answering the question of which of the components in a goal-complex, the goal or reason, better explains variation in learning outcomes. For both MAp and PAp goals, studies have found autonomous reasons predict optimal learning outcomes, including student engagement, deep-level learning strategies, academic satisfaction, persistence, well-being, and academic achievements (Benita et al., 2022; Gillet et al., 2014; Michou et al., 2014; Vansteenkiste et al., 2010). Controlled reasons predict less optimal outcomes, such as academic anxiety, self-handicapping, surface-level strategies, academic exploitation, and reduced well-being and academic achievements (Benita et al., 2022; Gillet et al., 2014; Sommet et al., 2018; Vansteenkiste et al., 2010). MAp and PAp goals sometimes predict learning outcomes over and above the effect of the reasons and sometimes do not, depending on the outcome variable and the study design. Altogether, these studies suggest that both the goals themselves and their underlying reasons play a crucial role in predicting academic outcomes.

A complementary approach is to probe interactions between goals and reasons and examine whether MAp and PAp goals predict learning outcomes when students endorse them for different levels of autonomous or controlled reasons. This line of research has revealed MAp and PAp goals predict more optimal learning outcomes when the reasons for their pursuit are autonomous, instead of controlled (Benita et al., 2022; Gaudreau, 2012; Gillet et al., 2014).

Senko and Tropiano (2016) and Sommet and Elliot (2017) offered a third approach. These researchers claimed goals and their underlying reasons are not separate entities. Rather, when a goal is endorsed for a certain reason, it is embedded within the reason. In other words, a goal-complex includes both the goal and its underlying reasons (e.g., 'I want to outperform others BECAUSE this goal is important for me'). Thus, instead of exploring additive and interactive effects of goals and reasons, their measurement approach views distinct goal-complexes as omnibus constructs. In line with other research, these researchers found goal-complexes involving autonomous reasons predicted the most adaptive outcomes. However, Sommet and Elliot (2017) found there were different effects for MAp and PAp goals. Whereas the autonomous-MAp-complex was the sole significant predictor of preference for challenging tasks and study persistence, the autonomous-PAp goal-complex was the sole predictor of grade aspirations. Both goal-complexes, however, predicted deep-learning strategies. This differentiated pattern suggests that the goal complexes for each goal type should be examined separately. In the present research, we took this approach in measuring MAp and PAp goal-complexes.

Limitations of variable-centered approaches and the merit of person-centered approaches to study goal-complexes

So far, all the studies employing the goal-complex model have used a variable-centered approach. Despite the convincing evidence favoring achievement goals pursued for autonomous reasons, there are several limitations to this approach. First, it assumes there is a dichotomy of goal-complexes: there is either an autonomous goal-complex or a controlled goal-complex. However, research has found positive correlations between autonomous and controlled reasons (e.g., Benita et al., 2022; Michou et al., 2014). Thus, it is highly likely that some students endorse goals for both reasons, and many do not endorse a goal for purely autonomous or controlled reasons. In addition, if a given goal can be endorsed for several reasons simultaneously, there are likely more than two goal-complexes, involving different combinations of goals and reasons.

Another concern is more theoretical. While goal orientation models suggest students who strive to develop competence (i.e., endorse MAp goals) typically do so for autonomous reasons (e.g., curiosity, interest), and those who aim to outperform others (i.e., endorse PAp goals) typically do so for controlled reasons (e.g., ego involvement, impression management), research on achievement goal complexes paints a different picture. Specifically, a recent meta-analysis by Senko et al. (2023), reviewing over 20 goal-complex studies, revealed both MAp and PAp goals are more likely to be endorsed for autonomous than controlled reasons. Thus, the extent to which students actually endorse MAp and PAp goals for controlled reasons remains unclear (for a similar critique, see Janke, 2024).

We used LPA to address these questions. LPA allowed us to identify and examine naturally occurring subgroups of students differing in terms of the degree to which their goals were endorsed for autonomous or controlled reasons. Because this approach relies less heavily on strict theoretical a-priori assumptions, we argued it could help us detect whether there are more goal-reason configurations than those originally posited by the theory, as well as which goal-complexes exist and how common they are. Importantly, it would yield a fine-grained view of which combinations of goals and reasons predict adaptive learning outcomes.

We assumed several possible combinations - or profiles - of autonomous and controlled reasons would emerge. Broadly speaking, these profiles should vary in the *type*, *degree*, and *congruence* of the reasons reported (for a similar argument, see Benita & Niemiec, 2025). For example, some profiles might differ by the type of reasons reported (i.e., autonomous vs. controlled), while others might reflect a dosage effect, differing in the degree to which a single reason is reported (e.g., high vs. low autonomous motivation). Finally, profiles might vary in terms of congruence, that is, the extent to which autonomous and controlled reasons are simultaneously reported (e.g., high in both), or in terms of conflict (e.g., high autonomous and low controlled motivation).

Relationships between achievement goal-complex profiles and students' behavioral and agentic engagement

In addition to examining the structure of goal-complex profiles, a second aim of the current research was to explore the relationship between profile membership and students' engagement. Engagement is a core outcome in school motivation research. It is a multidimensional construct that broadly refers to the extent of a student's active involvement in learning activities (Reeve, 2012; Reschly & Christenson, 2022). In this study, we focused on two key dimensions of engagement that capture distinct yet complementary ways in which students interact with their learning environment: behavioral and agentic engagement. *Behavioral engagement* refers to students' participation and involvement in classroom activities, reflecting the effort they invest in learning (Reeve & Lee, 2014; Skinner et al., 2008). It captures students' compliance with and responsiveness to classroom expectations, as evidenced by their level of participation and the effort they devote to academic tasks. *Agentic engagement*, in contrast, involves students' proactive and self-determined efforts to shape and enrich their learning environment (Reeve, 2013). It reflects a student's active role in expressing preferences, voicing ideas, and contributing to the learning process.

Of particular interest in this study were both students' and teachers' reports of these engagement dimensions. These two sources represent the most common approaches to assessing engagement and each offers unique value (Fredricks, 2022; Skinner et al., 2009). While students' self-reports capture their subjective experience of engagement, teachers' reports reflect students' observable behavior.

Recently, Michou et al. (2023) demonstrated that students' and teachers' weekly reports of behavioral and agentic engagement are positively correlated. These researchers also examined how autonomous and controlled reasons for engaging in study activities relate to both types of engagement. They found that while autonomous reasons were positively associated with both teachers' and students' reports of behavioral and agentic engagement, controlled reasons were negatively associated only with teachers' reports. Thus, despite their overall compatibility, teachers' and students' reports of engagement appear to be shaped by distinct motivational processes. Specifically, variation in students' observed (teacher-reported) engagement is influenced by both autonomous and controlled reasons, whereas variation in experienced (student-reported) engagement is driven solely by autonomous reasons. A possible explanation is that teachers may be particularly attuned to observable signs of students' controlled motivation, perceiving such students as less engaged. In contrast, students may still experience themselves as engaged when driven by controlled motivation, especially when it coexists with autonomous motivation.

By adopting both goal-complex and person-centered approaches, this study aims to shed further light on these findings. First, the goal-complex approach extends Michou et al.'s (2023) work beyond general autonomous and controlled reasons for study activities to focus on the reasons for pursuing MAp or PAp goals specifically. If differences in engagement reports emerge based on the type of goal-complex (MAp vs. PAp), this would suggest that, beyond the underlying reasons, the nature of the goal itself also contributes to students' engagement. Second, the person-centered approach allows us to explore how the relative 'dosage' of autonomy or control within individual motivational profiles explains variation in different types of engagement - and whether this variation is reflected differently in experienced (student-reported) versus observed (teacher-reported) engagement.

The present investigation

We report on a study in which we explored Peruvian high-school students' motivation for mathematics. We focused on mathematics because of its relevance for later college and career choices (Cooper et al., 2002) and for its role to predict later college graduation (National Mathematics Advisory Panel, 2008). Drawing on the goal-complex model of achievement goals, we asked how many goal-complexes (profiles involving autonomous and controlled reasons) exist for each goal (MAp and PAp) and the prevalence of each profile. Because no previous study has used a person-centered approach to study goal-complexes, we did not have a-priori hypotheses on the number of profiles that would emerge for each goal. Nevertheless, we assumed the profiles would vary in type, degree, and congruence of autonomous and controlled reasons.

Next, we tested how the profiles compared across students' behavioral and agentic engagement in mathematics lessons, as reported by both students and teachers. We did not form separate hypotheses for each type of engagement or for the type of goal-complex (MAp or PAp). Following previous research using the goal-complex model (e.g., Benita et al., 2022), we hypothesized students in profiles involving high autonomous reasons and/or low controlled reasons would report increased behavioral and agentic engagement. Conversely, students in profiles involving low autonomous reasons and/or high controlled reasons would report reduced behavioral and agentic engagement. In addition, following Michou et al.'s (2023) findings, we expected students in profiles characterized by either above- or below-average levels of autonomous reasons *or* above- or below-average levels of controlled reasons would vary in their levels of teacher-reported engagement. In contrast, only students in profiles with above- or below-average levels of autonomous reasons were expected to vary in levels of self-reported engagement.

Method

Participants and procedures

Participants were 395 Peruvian students in grades seven to 11 (23.5% from 7th grade, 18.7% from 8th grade, 18.5% from 9th grade, 20% from 10th grade, and 19.2% from 11th grade). Just over half, 52.7%, were girls; mean age = 13.72, SD = 1.43) from 11 classes in one school serving low-class families in Lima, Peru. Working with this type of sample is important because this group is especially likely to underperform in mathematics (Hanushek & Rivkin, 2006). The school is in San Juan de Lurigancho district. The residents are primarily migrants from rural areas with incomplete or insufficient education and have low socioeconomic status. Poverty and extreme poverty are prevalent; the district has the highest number of poor residents in Lima. Moreover, residents express concerns about the insecurity in their neighborhoods due to common crime, urban violence, and the presence of gangs and drugs. The study's aims and questionnaires were presented to the school's principal, who granted approval for its implementation. Parental consent was not necessary, as the school already had an existing agreement with parents allowing the inclusion of several activities. Students' participation was voluntary. All students agreed to participate.

We used a prospective design, with students' goal-complexes assessed at the beginning of the school year and their engagement measured at the end. Students' questionnaires were administered by trained research assistants. Students completed the questionnaires during their mathematics class; this took about 25 min. The teacher was not present in the classroom. The research assistants instructed students to think about their mathematics class when answering the questionnaire. They also administered the teachers' questionnaires and collected them in sealed envelopes one week later. Teachers rated each student's behavioral engagement in the classroom.

Measures

Tables 1 and 2, corresponding to MAp and PAp goals respectively, present the descriptive statistics for the study's instruments. All questionnaires were in Spanish, and students answered on a Likert-type scale, ranging from not at all true (1) to very true (6), except where indicated.

Underlying reasons for map goals and pap goals

The measure was based on the scale developed by Vansteenkiste et al. (2010). Students were initially presented with a single item to assess the degree to which they endorsed each achievement goal. This item was adapted from the 3 × 2

Table 1 Descriptive statistics and intercorrelations of study variables for map Goal-Complexes ($n = 392$)

Variable	M	SD	1	2	3	4	5	6
Time 1								
1. Autonomous MAp	4.99	0.97	-					
2. Controlled MAp	3.90	1.35	0.27**	-				
Time 2								
3. Behavioral engagement$_s$	4.83	0.85	0.28**	0.14**	-			
4. Agentic engagement$_s$	4.51	1.09	0.28**	0.20**	0.73**	-		
5. Behavioral engagement$_t$	3.93	0.76	0.06	−0.22**	0.06	0.08	-	
6. Agentic engagement$_t$	3.63	0.77	0.01	−0.20**	0.07	0.07	0.68**	-

MAp = mastery approach. Subscript 's' refers to student reports; Subscript 't' refers to teacher reports. **p < .01

Table 2 Descriptive statistics and intercorrelations of study variables for pap Goal-Complexes ($n=364$)

Variable	M	SD	1	2	3	4	5	6
Time 1								
1. Autonomous PAp	4.78	1.16	-					
2. Controlled PAp	3.81	1.42	0.41**	-				
Time 2								
3. Behavioral engagement$_s$	4.83	0.87	0.22**	0.13*	-			
4. Agentic engagement$_s$	4.52	1.11	0.21**	0.15**	0.74**	-		
5. Behavioral engagement$_t$	3.93	0.77	−0.04	−0.24**	0.07	0.08	-	
6. Agentic engagement$_t$	3.61	0.78	−0.03	−0.18**	0.09	0.09	0.68**	-

PAp = performance approach. Subscript ‘s’ refers to student reports; Subscript ‘t’ refers to teacher reports. *$p<.05$, **$p<.01$

Achievement Goal Questionnaire (3 × 2 Elliot et al., 2011). This scale differentiates MAp goals into two distinct categories: task-approach goals (‘My goal in this class is to completely master the material’), and self-approach goals (‘My goal in this class is to know the material better than I did before’). PAp goals were assessed by a single item (‘My goal in this class is to do well compared to other students’).

For each item (representing a specific goal), students rated their level of endorsement on a Likert scale ranging from 1 (not at all true) to 6 (very true) and then immediately provided reasons for endorsing the goal. Two items assessed autonomous reasons (e.g., ‘Because this is an important goal to me’), and four items assessed controlled reasons (e.g., ‘Because I would feel guilty if I didn’t do so’). We averaged the items tapping reasons for task-approach and self-approach goals into two reasons for MAp goal scales - one for autonomous reasons and one for controlled reasons[2]. Thus, by averaging across the autonomous and controlled reasons for each goal separately, four scales were created in total: autonomous and controlled reasons for MAp goals, and autonomous and controlled reasons for Pap goals.

In our analyses, we excluded participants who did not endorse a given goal (i.e., those who selected ‘1’ on the goal endorsement item preceding the ‘reasons’ items), as providing reasons for non-endorsed goals would be irrelevant. Three participants were removed from the dataset for MAp goal reasons, and 31 for PAp goal reasons. Because different participants were excluded for each goal, we conducted the analyses using separate datasets for each goal.

Cronbach’s alphas were 0.83 and 0.92 for autonomous and controlled reasons for MAp goals, respectively. For PAp goals, Cronbach’s alphas were 0.79 and 0.86 for autonomous and controlled reasons, respectively.

Students’ reports of behavioral engagement and agentic engagement

Students’ experienced behavioral engagement was assessed using the five-item scale developed by Skinner et al. (2008) (e.g., ‘When I’m in this class, I listen very carefully’). Experienced agentic engagement was assessed using the five-item scale developed by Reeve (2013) (e.g., ‘I let my teacher know what interests me’). Both types of engagement were assessed at the end of the academic year. Cronbach’s alphas were 0.84 for behavioral and 0.87 agentic engagement, respectively.

Teachers’ reports of students’ behavioral engagement and agentic engagement

Three items taken from Assor et al. (2005) measured observed behavioral engagement (e.g., ‘This student shows persistence as she/he works on assignments’). Three items adapted from Reeve (2013) measured observed agentic engagement (e.g., ‘This student lets me know what interests him’). Teachers responded on a Likert-type scale ranging from not at all true (1) to very true (5) at the end of the academic year. Cronbach’s alphas were 0.88 for behavioral and 0.80 agentic engagement, respectively.

Plan of analysis

We performed LPA using Latent Gold 6.0 (Vermunt & Magidson, 2021), estimating the best fitting subgroups for students with similar patterns of goals and underlying reasons. Starting with a two-profile model, we iteratively added up to K = 8. To determine the best fitting solution, we considered multiple fit criteria outlined by Nylund et al. (2007). We used the Bayesian information criterion (BIC) and the Akaike information criterion (AIC) to compare the relative fit of multiple models to the data while considering the complexity and the sample size of each model. Lower AIC and BIC values indicate a better fit (Raftery, 1995). For statistical model comparison, we performed the Vuong-Lo-Mendell-Rubin (VLMR) test (Vuong, 1989). A significant p-value

[2] Exploratory factor analysis with varimax rotation supported this aggregation, revealing two components. The first component (eigenvalue = 5.26) comprised the eight items reflecting controlled reasons, and the second component (eigenvalue = 2.55) comprised the four items reflecting autonomous reasons. All factor loadings exceeded 0.52.

indicates the k-profile solution fits the data better than the k-1 model. In addition, we determined the value of entropy, indicating the classification accuracy of the profile solution. Entropy values of 0.8 and above indicate good classification accuracy (Spurk et al., 2020). We also considered bivariate residuals. Statistically significant bivariate residuals indicate a violation of the local independence assumption. Thus, smaller and non-significant residuals suggest an adequate model fit (Visser & Depaoli, 2022). Interpretability of the class solutions, differentiability of the individual profiles, and class sizes were considered as well (Lubke & Muthén, 2005). To avoid local maxima, we used 500 random starting sets with 1000 iterations each.

After identifying the final model, we interpreted the profiles. To enhance profile comparability, we calculated standardized z-scores for the profile indicators. We used t-tests to examine whether each latent class's mean score for each indicator significantly differed from the overall sample mean of that indicator. Non-significant tests indicated that the class mean was similar to the overall sample average, and we labeled these indicators as 'average.' Significant tests indicated that the indicator's mean was meaningfully higher or lower than average, allowing us to interpret these indicators accordingly. For z-scores lower than 1, we labeled the indicator as 'above average,' and for z-scores of 1 and above, we labeled the indicator as 'high.'

To examine whether profile membership predicts student and teacher reports of behavioral and agentic engagement, we used the Step-3 procedure in Latent GOLD 6.0. This approach estimates regression parameters for continuous outcomes using the Bolck–Croon–Hagenaars (BCH) method (Bolck et al., 2004), which applies a weighted analysis that corrects for classification error inherent in assigning individuals to latent classes. Rather than assigning individuals to a single profile, this procedure retains posterior membership probabilities and uses them to weight outcome scores, thereby preserving uncertainty in class membership. We employed *effect coding* to express each profile's deviation from the grand mean of the outcome variable. Unlike *dummy coding*, which compares each profile to a reference group, effect coding centers estimates around the overall sample mean, allowing each regression coefficient to reflect how that profile differs from the grand mean. This enhances interpretability by avoiding comparisons to an arbitrarily chosen reference class and ensures that all regression coefficients sum to zero (Vermunt, 2010).

Results

Preliminary analyses

Correlations for MAp goals are reported in Table 1. Autonomous reasons for MAp goals were positively related with controlled reasons. They were also positively related with students' reports of behavioral and agentic engagement. Controlled reasons for MAp goals were positively related with students' reports of behavioral and agentic engagement but negatively related with teachers' reports of behavioral and agentic engagement. Correlations for PAp goals are reported in Table 2. Autonomous reasons for PAp goals were positively related with controlled reasons and positively related with students' reports of behavioral and agentic engagement. Controlled reasons for PAp goals were positively related with students' reports of behavioral and agentic engagement, but negatively related with teachers' reports of behavioral and agentic engagement.

LPA

MAp goal-complex profiles

Profile identification Table 3 presents model fit statistics. The fit statistics BIC and AIC, along with the significant p-value in the VLMR statistics, indicated a better fit was obtained as more profiles were considered, up to a seven-profile solution, where BIC levels increased. From four profiles onwards, the maximum bivariate residual was non-significant. Model fit differences between the five- and six-profile solutions were very small. We therefore inspected the five- and six-profile solutions. Entropy and classification error indices were similar across both solutions. In addition, the smallest profile in the five-profile solution contained 6% ($n=25$) of the sample, corresponding to a large enough and clearly distinguished group of participants. The smallest profile in the six-profile solution contained only 3% of the sample ($n=12$). We therefore selected the five-profile solution.

Profile interpretation Table 4 presents descriptive statistics for the five-profile solution. Figure 1 shows a graphical representation of this solution based on standardized scores. The first profile (40% of the sample, $n=157$) included participants reporting below average levels of autonomous reasons for MAp goals, $t(391) = -4.14$, $p<.05$ and average levels of controlled reasons, $t(391)=1.11$, $p>.05$. We labeled this profile 'below-average autonomous – average controlled MAp'. The second profile (20%, $n=80$) included participants reporting above-average levels of autonomous

Table 3 Model fit statistics for LPA models

Number of *P*	LL	BIC	Size of Drop in BIC	AIC	Npar	Max. BVR	VLMR	*p*-value	Classif. Error	Entropy	Size of smallest *P*
MAp Goal-Complex Profiles											
1	−1217.98	2459.85		2443.97	4	27.89			0	1	
2	−1133.22	2320.19	139.66	2284.45	9	6.82	169.52	0.000	0.079	0.701	33%
3	−1048.13	2179.86	140.33	2124.26	14	5.57	170.19	0.000	0.087	0.770	20%
4	−1006.1	2125.65	54.21	2050.20	19	1.76	84.07	0.000	0.131	0.754	20%
5	**−981.175**	**2105.66**	**19.99**	**2010.35**	**24**	**1.02**	**49.85**	**0.000**	**0.094**	**0.825**	**6%**
6	−965.514	2104.19	1.47	1989.03	29	0.55	31.32	0.000	0.096	0.829	3%
7	−951.629	2106.28	−2.09	1971.26	34	0.24	27.77	0.001	0.135	0.798	3%
8	−937.254	2107.39	−1.11	1952.51	39	0.76	28.75	0.003	0.128	0.821	4%
PAp Goal-Complex Profiles											
1	−1213.91	2451.41		2435.82	4	62.32			0	1	
2	−1124.43	2301.93	149.48	2266.86	9	13.37	178.96	0.000	0.095	0.689	43%
3	−989.27	2061.10	240.83	2006.54	14	3.72	270.32	0.000	0.063	0.831	25%
4	−923.48	1959.01	102.09	1884.96	19	1.69	131.58	0.000	0.055	0.885	14%
5	**−825.89**	**1793.32**	**165.69**	**1699.79**	**24**	**1.46**	**195.17**	**0.000**	**0.030**	**0.943**	**15%**
6	−701.64	1574.30	219.02	1461.28	29	1.46	248.51	0.000	0.005	0.988	12%
7	−664.26	1529.03	45.27	1396.52	34	0.00	74.76	0.000	0.009	0.984	7%
8	−631.45	1492.90	36.13	1340.91	39	0.49	65.61	0.000	0.008	0.988	0.03%

LPA = latent profile analysis; P = profile(s); LL = log-likelihood; BIC = Bayesian information criterion; AIC = Akaike information criterion 3; Npar = Number of parameters; BVR = Bivariate residual; VLMR = Vuong-Lo-Mendell-Rubin; MAp = mastery approach, PAp = performance approach. Bold numbers show the best profile solution

Table 4 Means per profile

			Autonomous MAp		Controlled MAp	
Latent profile	%	n	M (SE)	Z-score	M (SE)	Z-score
1. Below average autonomous - average controlled MAp	40%	157	4.68 (0.07)	−0.31*	3.99 (0.08)	0.07
2. Multiple reasons - high controlled MAp	20%	80	5.45 (0.05)	0.48*	5.26 (0.09)	1.01*
3. High autonomous - average controlled MAp	20%	79	6.00 (0.01)	1.04*	3.98 (0.18)	0.06
4. Average autonomous - low controlled MAp	13%	51	4.78 (0.18)	−0.21	1.87 (0.11)	−1.51*
5. Low autonomous - below-average controlled MAp	7%	25	2.57 (0.52)	−2.48*	2.82 (0.29)	−0.80*
			Autonomous PAp		Controlled PAp	
Latent profile	%	n	M (SE)	Z-score	M (SE)	Z-score
1. High autonomous - above average controlled PAp	26%	93	6.00 (0.01)	1.05*	4.15 (0.17)	0.24*
2. Below-average autonomous - above-average controlled PAp	22%	81	4.29 (0.04)	−0.43*	4.20 (0.11)	0.28*
3. Low multiple reasons for PAp	20%	73	3.08 (0.15)	−1.48*	2.33 (0.13)	−1.04*
4. Above-average autonomous - average controlled PAp	17%	63	5.00 (0.01)	0.19*	4.00 (0.16)	0.14
5. Above-average multiple reasons for PAp	15%	54	5.50 (0.01)	0.62*	4.36 (0.16)	0.41*

MAp = mastery approach, PAp = performance approach. Significant Z-scores differed from zero according to t-tests. $^{*}p < 05$

reasons, $t(391) = 8.52$, $p < .05$, and high levels of controlled reasons, $t(391) = 15.60$, $p < .05$. We labeled this profile 'multiple reasons - high controlled MAp'. The third profile (20%, $n = 79$) included participants reporting high levels of autonomous reasons, $t(391) = 184.51$, $p < .05$, and average levels of controlled reasons, $t(391) = 0.43$, $p > .05$. We labeled this profile 'high autonomous – average controlled MAp'. The fourth profile (13%, $n = 51$) included participants reporting average levels of autonomous reasons, $t(391) = -1.11$, $p > .05$, and low levels of controlled reasons, $t(391) = -18.11$, $p < .05$. We labeled it 'average autonomous-low controlled MAp'. The fifth profile (7%, $n = 25$) included participants reporting low levels of autonomous reasons, $t(391) = -4.61$, $p < .05$, and below-average levels of controlled reasons $t(391) = -3.75$, $p < .05$. We labeled this profile 'low autonomous – below-average controlled MAp'.

Relations between map goal-complex profile membership and student outcomes Table 5 presents the final model, in which latent profile membership relates to students' behavioral and agentic engagement at the end of the school year. Students in the 'multiple reasons - high controlled MAp' and the 'high autonomous - average controlled MAp' pro-

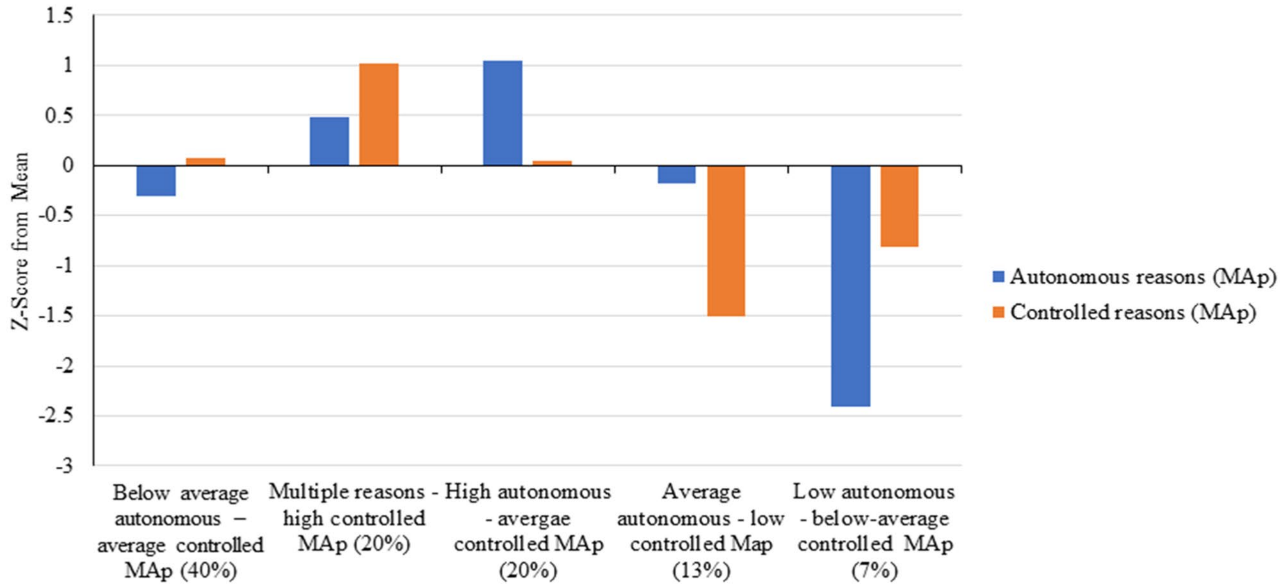

Fig. 1 MAp Goal-Complex Profiles. MAp=mastery approach

Table 5 Regression model of map Goal-Complex profile membership predicts students' engagement

Outcome	Latent profile	Coefficient	SE	*p* value
Behavioral engagement$_s$	1. Below average autonomous – average controlled MAp	−0.04	−0.50	0.610
	2. Multiple reasons - high controlled MAp	**0.32**	**3.40**	**0.001**
	3. High autonomous - average controlled MAp	**0.35**	**3.57**	**0.000**
	4. Average autonomous - low controlled MAp	0.08	0.56	0.580
	5. Low autonomous - below-average controlled MAp	**−0.71**	**−4.37**	**0.000**
Agentic engagement$_s$	1. Below average autonomous – average controlled MAp	−0.10	−0.86	0.390
	2. Multiple reasons - high controlled MAp	**0.48**	**3.99**	**0.000**
	3. High autonomous - average controlled MAp	**0.54**	**4.26**	**0.000**
	4. Average autonomous - low controlled MAp	−0.25	−1.44	0.150
	5. Low autonomous - below-average controlled MAp	**−0.67**	**−3.17**	**0.002**
Behavioral engagement$_t$	1. Below average autonomous – average controlled MAp	−0.08	−1.11	0.270
	2. Multiple reasons - high controlled MAp	**−0.21**	**−2.01**	**0.045**
	3. High autonomous - average controlled MAp	0.07	0.80	0.420
	4. Average autonomous - low controlled MAp	**0.35**	**3.28**	**0.001**
	5. Low autonomous - below-average controlled MAp	−0.13	−1.01	0.310
Agentic engagement$_t$	1. Below average autonomous – average controlled MAp	−0.14	−1.69	0.091
	2. Multiple reasons - high controlled MAp	−0.17	−1.63	0.100
	3. High autonomous - average controlled MAp	−0.01	−0.06	0.950
	4. Average autonomous - low controlled MAp	**0.37**	**3.52**	**0.000**
	5. Low autonomous - below-average controlled MAp	−0.06	−0.38	0.700

MAp = mastery approach; PAp = performance approach. Subscript 's' refers to student reports; Subscript 't' refers to teacher reports files reported higher levels of behavioral (b = 0.23, $p < .001$, b = 0.35, $p < .001$, respectively) and agentic engagement (b = 0.48, $p < .001$, b = 0.54, $p < .001$, respectively). Interestingly, unlike the student self-reports, students in the 'multiple reasons – high controlled MAp' profile had lower teacher-reported levels of behavioral engagement (b=−0.21, $p < .045$). In addition, students in the 'low autonomous - below-average controlled MAp' profile reported lower levels of behavioral and agentic engagement (b=−0.71, $p < .001$, b=−0.67, $p < .002$, respectively). Finally, students in the 'average autonomous - low controlled MAp' profile had higher teacher-reported levels of behavioral and agentic engagement (b = 0.35, $p < .001$, b = 0.37, $p < .001$, respectively).

PAp goal-complex profiles

Profile identification

Table 3 presents the model fit statistics for the different profile solutions. The maximum bivariate residual was non-significant from the four-profile solution onward. The fit statistics - BIC and AIC, along with the significant p-value in the VLMR test - indicated that model fit improved as more profiles were considered. The largest drop in BIC occurred between the five- and six-profile solutions, suggesting that the six-profile solution should be selected. However, upon interpretation, two highly similar profiles emerged, with no meaningful or interpretable differences. We therefore examined the five-profile solution, which exhibited high entropy (0.943) and featured relatively even and clearly distinguished profiles. We therefore ultimately selected the five-profile solution.

Profile interpretation

Table 4 presents the descriptive statistics of the different profiles in the five-profile solution. Figure 2 shows a graphical representation of the five-profile solution based on standardized scores. The first profile (26% of the sample, n=93) included participants reporting high levels of autonomous reasons, t(363) = 217.34, p<.05, and above-average levels of controlled reasons, t(363) = 2.03, p<.05. We therefore labeled it 'high autonomous - above average controlled PAp'. The second profile (22%, n=81) included participants reporting below-average levels of autonomous reasons, t(363) = −13.49, p<.05, and above-average levels of controlled reasons, t(363) = 3.46, p<.05. We labeled this profile 'below-average autonomous - above-average controlled PAp'. The third profile (20%, n=74) included participants reporting low levels of both autonomous controlled reasons, t(363) = −11.44, p<.05, t(363) = −11.31, p<.05, respectively. We labeled this profile 'low multiple reasons for PAp'. The fourth profile (17%, n=63) included participants reporting above-average levels autonomous reasons, t(363) = 26.80, p<.05, and average levels of controlled reasons, t(363) = 1.26, p>.05. We labeled this profile 'above-average autonomous - average controlled PAp'. The fifth profile (15%, n=54) included participants reporting above-average levels of both autonomous and controlled reasons, t(363) = 74.70, p<.05, t(363) = 3.69, p<.05, respectively. We labeled it 'above-average multiple reasons for PAp'.

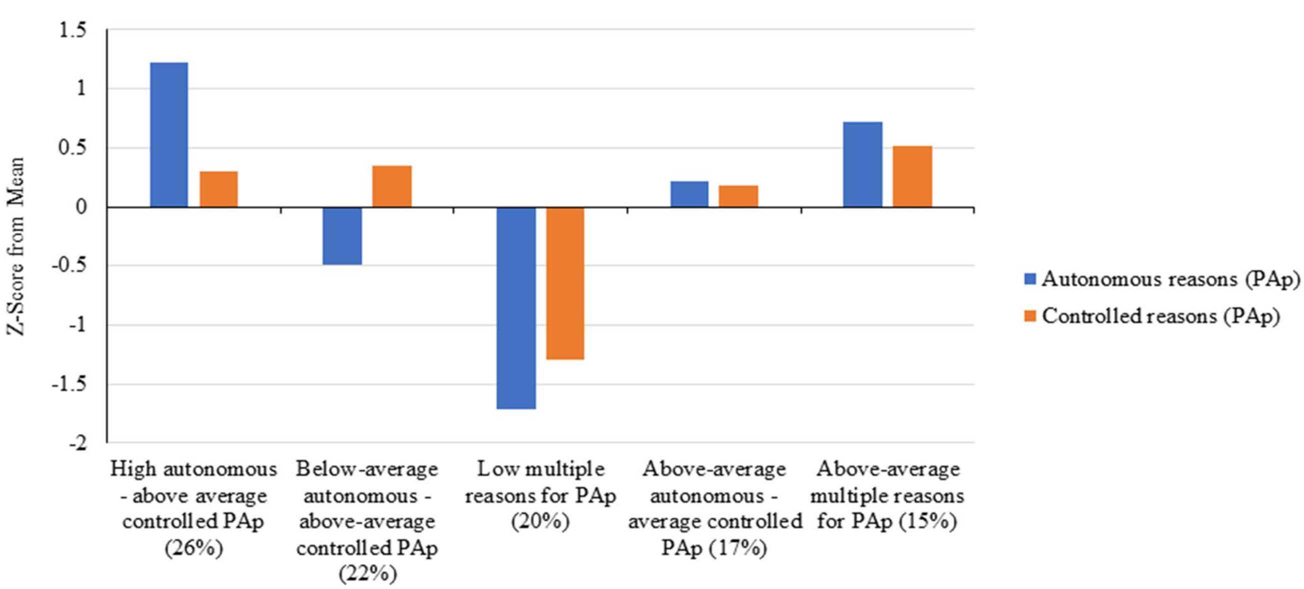

Fig. 2 PAp Goal-Complex Profiles. PAp=performance approach

Table 6 Regression model of pap Goal-Complex profile membership predicts students' engagement

Outcome	Latent profile	Coefficient	SE	*p* value
Behavioral engagement$_s$	1. High autonomous - above average controlled PAp	0.16	0.09	0.070
	2. Below-average autonomous - above-average controlled PAp	**−0.18**	**0.09**	**0.046**
	3. Low multiple reasons for PAp	**−0.33**	**0.12**	**0.008**
	4. Above-average autonomous - average controlled PAp	−0.11	0.08	0.210
	5. Above-average multiple reasons for PAp	**0.46**	**0.08**	**0.000**
Agentic engagement$_s$	1. High autonomous - above average controlled PAp	**0.35**	**0.12**	**0.002**
	2. Below-average autonomous - above-average controlled PAp	−0.18	0.12	0.120
	3. Low multiple reasons for PAp	**−0.39**	**0.14**	**0.007**
	4. Above-average autonomous - average controlled PAp	−0.04	0.12	0.750
	5. Above-average multiple reasons for PAp	**0.27**	**0.12**	**0.027**
Behavioral engagement$_t$	1. High autonomous - above average controlled PAp	−0.11	0.09	0.220
	2. Below-average autonomous - above-average controlled PAp	**−0.21**	**0.08**	**0.012**
	3. Low multiple reasons for PAp	**0.32**	**0.09**	**0.000**
	4. Above-average autonomous - average controlled PAp	0.06	0.09	0.540
	5. Above-average multiple reasons for PAp	−0.51	0.09	0.590
Agentic engagement$_t$	1. High autonomous - above average controlled PAp	−0.09	0.08	0.260
	2. Below-average autonomous - above-average controlled PAp	−0.14	0.09	0.100
	3. Low multiple reasons for PAp	**0.23**	**0.10**	**0.019**
	4. Above-average autonomous - average controlled PAp	−0.06	0.10	0.540
	5. Above-average multiple reasons for PAp	0.06	0.10	0.550

MAp = mastery approach; PAp = performance approach. Subscript 's' refers to student reports; Subscript 't' refers to teacher reports

Relations between pap goal-complex profile membership and student outcomes

Table 6 presents the final model, illustrating how latent profile probability related to students' behavioral and agentic engagement at the end of the school year. Students in the 'high autonomous - above average controlled PAp' profile reported higher levels of agentic engagement (b = 0.35, $p < .002$), but not behavioral engagement. Students in the 'below-average autonomous - above-average controlled PAp' and the 'low multiple reasons for PAp' profiles had lower levels of self-reported behavioral engagement (b=−0.18, $p < .046$, b=−0.33, $p < .008$, respectively), and the latter profile also reported lower levels of agentic engagement (b=−0.39, $p < .007$). Interestingly, unlike the student self-reports, students in the teacher-reported 'low multiple reasons for PAp' profile had higher levels of behavioral and agentic engagement (b = 0.32, $p < .001$, b = 0.23, $p < .019$, respectively). Finally, students in the 'above-average multiple reasons for PAp' profile reported higher levels of behavioral and agentic engagement (b = 0.46, $p < .001$, b = 0.27, $p < .027$, respectively).

Discussion

In this study, we employed a person-level approach to further elaborate the goal-complex model of achievement goals. The study identified five distinct goal profiles for both MAp and PAp goals, based on varying combinations of autonomous and controlled reasons. Profiles characterized by high autonomous reasons were generally associated with greater student-reported engagement, while those low in autonomous reasons showed weaker or negative associations with engagement. Profiles characterized by high controlled reasons were generally associated with reduced teacher-reported engagement, while those low in controlled reasons showed positive associations with engagement. We now turn to a more detailed discussion of these findings.

Structure of map and pap goal-complex profiles

Overall, the structure of the emerging profiles reveals subtle differences in how autonomous and controlled reasons underlying MAp and PAp goals covary. As expected, for both goals, the profiles varied in the type, degree, and congruence of the reported reasons. In other words, the profiles differed in the predominant type of reasons, the extent to which the goals were endorsed, and whether the two reasons were endorsed to similar or differing degrees. These findings suggest achievement goal-complexes extend beyond a simple dichotomy of autonomous-MAp/PAp and controlled-MAp/PAp.

An important finding is that both types of goals, a sizable portion of the sample endorsed them for both autonomous and controlled reasons, as reflected in profiles characterized by at least average levels of both reasons. Specifically, 40% of the sample reported pursuing MAp goals for both reasons (Profiles 2 and 3), and 56% endorsed PAp goals for both reasons (Profiles 1, 4, and 5). This indicates that autonomous and controlled reasons are not mutually exclusive, and that students often endorse achievement goals for a mix of motives.

The profile structure also challenges the assumptions of traditional goal orientation models (Ames & Archer, 1988; Dweck, 1986; Maehr, 1984; Nicholls, 1984). As noted above, these models conceptualize MAp goals as inherently autonomous and non-controlled, and PAp goals as inherently controlled and non-autonomous. However, our results show that this pattern is relatively uncommon for either type of goal. For MAp goals, only the fourth profile - comprising just 13% of the sample - aligned with the assumptions of goal orientation models, as it reflected students endorsing MAp goals for average autonomous and low controlled reasons. For PAp goals, only the second profile - comprising 18% of the sample -demonstrated a pattern consistent with the goal orientation model, with participants more inclined to endorse PAp goals for controlled and less autonomous reasons. Finally, the most common PAp profile (profile 1) involved participants who endorsed the goals more strongly for autonomous than for controlled reasons.

This suggests that the achievement goal construct is more complex than what is predicted by traditional goal orientation models. While these models highlight an important phenomenon - namely, that some students are genuinely interested in developing their competence and mastering the material, while others, driven by ego-involvement, strive to demonstrate their abilities by outperforming others - such clear-cut patterns are relatively rare. Instead, students' endorsement of achievement goals appears to be a more nuanced process, involving multiple, and often overlapping, justifications and motivations.

Importantly, for both goals, a profile characterized by low levels of both autonomous and controlled reasons emerged. We hypothesize these participants were likely those least inclined to adopt the goals altogether, a notion supported by our follow-up analyses (see Supplemental Materials). As shown in Tables S1 and S2, participants in these profiles were the least likely to endorse either MAp or PAp goals. Moreover, as shown in Tables 5 and 6, membership in these profiles was associated with lower student-reported behavioral and agentic engagement, indicating these students were generally less motivated in their studies. Collectively, these findings suggest low goal endorsement represents a distinct and meaningful subgroup, consistent with prior LPA studies examining achievement goals without considering the underlying reasons for goal pursuit (e.g., Chan & Liem, 2023; Schwinger et al., 2016). Notably, our results indicate that the low-endorsement PAp profile was more prevalent than the corresponding MAp profile, likely because students are generally less inclined to report endorsing PAp goals.

Relationships of map and pap goal-complex profiles with students' engagement

Overall, our findings support previous research using the goal-complex model, indicating that the degree of autonomous and controlled reasons for goal endorsement accounts for variability in students' engagement (e.g., Benita et al., 2022; Gillet et al., 2017; Michou et al., 2014). Nevertheless, several noteworthy patterns emerged. Specifically, a differentiated pattern was observed between student and teacher reports of engagement. For student-reported engagement, membership in profiles characterized by high autonomous reasons positively predicted self-reported behavioral and/or agentic engagement. Conversely, membership in profiles with low autonomous reasons negatively predicted student-reported engagement. Notably, these effects emerged regardless of the level of controlled reasons within a profile. For example, in the second MAp profile - where students endorsed both above-average autonomous and high controlled reasons- they still reported heightened engagement, despite the elevated levels of controlled reasons.

In contrast, teacher-reported engagement exhibited a distinct pattern: membership in profiles characterized by low controlled reasons positively predicted teacher-reported behavioral and/or agentic engagement, whereas high controlled reasons negatively predicted these outcomes. Notably, these effects emerged regardless of the level of autonomous reasons within a profile. For example, in the third PAp profile, where students reported both low autonomous and low controlled reasons, teachers reported increased behavioral engagement and agentic engagement-despite the presence of low autonomous reasons.

Interestingly, this nuanced pattern was also evident in the diverging effects of certain profiles. In the case of MAp goals, the 'multiple reasons–high controlled MAp' profile was associated with higher student-reported behavioral and agentic engagement, yet it predicted lower behavioral engagement as perceived by teachers. In other words, students who pursued MAp goals for both autonomous and controlled reasons felt personally engaged in their learning. However, the simultaneous experience of controlled reasons for MAp goals among these students may have manifested in outward behaviors that were less aligned with teacher expectations of engaged learning.

Similarly, for PAp goals, the 'low multiple reasons for PAp' profile negatively predicted students' self-reported engagement, while positively predicting engagement as perceived by teachers. In other words, students' low levels of autonomous motivation for PAp goals were associated with a diminished sense of engagement. However, their simultaneously low levels of controlled reasons may have been outwardly manifested in fewer signs of internal conflict or pressure, which teachers may have interpreted as increased focus or enthusiasm for learning. An alternative explanation is that these students were generally less inclined to pursue PAp goals altogether, and this lack of pursuit was perceived by teachers as a positive indicator of engagement. Future research should explore these interpretations to clarify which explanation is more plausible.

These patterns partially align with the findings of Michou et al. (2023). In both studies, only teachers' reports of engagement were associated with students' controlled motivation. However, a key difference emerged regarding autonomous motivation: whereas in our study only students' self-reported engagement was related to autonomous reasons, Michou et al. found that both students' and teachers' reports were positively associated with autonomous motivation. Taken together, these findings underscore the complex interplay between students' internal motivational states and how those states are interpreted by external observers. Students' self-reported engagement appears to be primarily driven by their sense of autonomy in learning. When reflecting on their own engagement, students may place greater weight on their autonomous reasons, while discounting or overlooking controlled reasons. In contrast, teachers' perceptions - based on observable classroom behaviors - appear to reflect not only students' autonomy but also their controlled motivation, which may be outwardly expressed through behavioral cues such as tension, compliance, or resistance. As previous research suggests (e.g., Fredricks, 2022), both self-reports and teacher-reports of student engagement provide valuable but distinct perspectives. Thus, relying on either one in isolation risks offering an incomplete picture. Researchers are therefore urged to consider both types of reports when examining student engagement in order to capture its full complexity.

Additionally, several distinctions emerged in how profile membership predicted behavioral versus agentic engagement. For MAp goals, the second profile, characterized by heightened levels of both autonomous and controlled reasons, negatively predicted teachers' reports of behavioral engagement, but not agentic engagement. This pattern suggests that while these students' elevated autonomous motivation may have been sufficient to support their willingness to express personal preferences and initiative in class, their high controlled motivation may have undermined their overall effort, as perceived by teachers.

Finally, in the first PAp profile - marked by high autonomous and average controlled reasons - students reported higher agentic, but not behavioral, engagement. In contrast, the equivalent MAp profile (the third MAp profile) predicted both agentic and behavioral engagement. These findings indicate that autonomous motivation may be a key driver of students' agentic engagement. However, in the context of PAp goal endorsement, this autonomous drive may not be sufficient to translate into greater self-reported effort, possibly due to the performance-contingent nature of the goal.

Practical implications

The present findings offer several important implications for practitionners. First, the results suggest that educators should avoid categorizing students' motivations in binary terms and instead adopt a more nuanced approach that recognizes the coexistence of multiple motives within individual learners. Second, our findings underscore the importance of fostering autonomous reasons and preventing controlling ones for both MAp and PAp goals. Finally, the differentiated findings between teachers' and students' reports of engagement - particularly the prominent role of controlled motivation in predicting teacher-reported engagement - suggest that teachers may benefit from professional development that enhances their ability to distinguish among various expressions of engagement. Such training could also increase their awareness that some apparent signs of disengagement may stem from internal motivational conflicts rather than from a lack of ability or interest.

Limitations and direction for future research

This research has several limitations. First, the study was correlational, preventing us from making causal inferences. For example, it is likely that students' goal complexes changed over the course of the school year, and these changes in profile membership may have contributed to the variability in engagement observed at the end of the year. Another limitation is that the unique characteristics of the study constrain the generalizability of the findings. Specifically, the study was conducted among Peruvian high school students from relatively low-SES backgrounds. In addition, our sample included students from grades seven to eleven within a single school, resulting in a relatively wide age range but a limited number of participants per grade. Similar studies should be conducted in a variety of cultures and more diverse samples, and in other socioeconomic contexts, to examine whether the identified profiles and their associations with engagement generalize across different age groups and educational settings. Additionally, to enhance the generalizability of the findings, it is important to extend the research to academic subjects beyond mathematics.

Notably, unlike previous studies that employed both teacher and student reports of engagement (Michou et al., 2023; Rimm-Kaufman et al., 2015; Virtanen et al., 2015), in our study, these reports were uncorrelated. While several possible explanations exist for this discrepancy, they are beyond the scope of the present paper. Researchers have long argued that both perspectives provide important and unique insights into student engagement (Fredricks, 2022; Skinner et al., 2009). Moreover, our finding that each type of report is uniquely associated with distinct goal-complexes suggests that considering both sources offers a more comprehensive understanding of the impact of achievement goal-complexes.

An important direction for future research involves exploring profiles that simultaneously account for reasons underlying both MAp and PAp goals within a single latent profile analysis. Although the present study analyzed the goal complexes separately, future work could adopt a more integrative approach to examine how combinations of autonomous and controlled reasons across both goals co-occur within individuals. This could provide a richer understanding of multiple-goal profiles - such as those characterized by high endorsement of both MAp and PAp goals - and help clarify when such profiles are adaptive. While beyond the scope of the current study, this line of inquiry holds promise for advancing goal-complex theory and its applications in educational settings.

Another direction for future research is to extend goal-complex profiling to include avoidance goals. While the present study focused on approach-oriented goals (MAp and PAp) to maintain conceptual and analytic clarity, examining the reasons underlying avoidance goals may offer important insights into the motivational dynamics often overlooked in goal-complex research.

Conclusion

In conclusion, this study advances the goal-complex framework by adopting a person-centered approach to examine how combinations of autonomous and controlled reasons for pursuing MAp and PAp goals relate to students' engagement. Our findings reveal that students often endorse achievement goals for a mix of reasons, and that these motivational profiles differentially predict behavioral and agentic engagement as reported by both students and teachers. These results challenge the assumptions of traditional goal orientation models and underscore the complexity of students' motivational experiences. By deepening our understanding of how goal complexes operate in real classroom contexts, this study offers valuable insights for theory, research, and practice aimed at fostering more effective and personally meaningful student engagement.

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Declarations

Conflict of interest The authors declare no conflict of interest

Consent to participate All study procedures involving human participants were in accordance with the ethical standards of the institutional research committee or comparable ethical standards

Informed consent form Informed consent was obtained from all participants. All authors consented to the submission of this manuscript.

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