

Academic motivation profiles and their association with burnout in Brazilian university students in physical education and physiotherapy

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Abstract:

Objective: The main objective of the current study was to identify distinct profiles of academic motivation through cluster analysis in a representative sample of Brazilian university students of physical education and physiotherapy. Subsequently, considering the scarcity of research on this topic, the second objective was to verify the existing associations between the identified academic motivation clusters and signs suggestive of academic burnout. **Methods:** The sample consisted of 497 university students (63% women). Data were collected using the *Academic Motivation Scale* and *Burnout Assessment Tool – Core Symptoms Short Version*. Cluster analysis was utilized to identify specific groupings of the seven motivation subscales. Binary logistic regression was used to verify the association between each cluster solution and signs suggestive of academic burnout. **Results:** Three clusters were generated with different configurations of coexistence and gradients of individual engagement of the academic motivation subscales, namely high, moderate, and low self-determination. University students grouped in the low self-determination cluster, characterized by higher amotivation scores accompanied by lower scores in the three intrinsic motivation subscales (knowledge, accomplishment and experience stimulation) and in the extrinsic motivation of identified regulation, demonstrated a two and a half times greater chance of presenting signs suggestive of academic burnout than their peers in the high self-determination cluster (OR = 2.48 [95%CI 1.61 – 4.36]; $p < 0.001$). In the case of university students grouped in the moderate self-determination cluster, the chances of showing signs suggestive of academic burnout were not significantly different compared to their peers grouped in the high self-determination cluster (OR = 1.52 [95%CI 0.98 – 2.74], $p = 0.053$). **Conclusion:** The findings are relevant and offer interesting evidence to support the proposal of stratifying university students according to clusters of subscales of the self-determination continuum, in order to identify specific issues and design more effective intervention actions to promote autonomous academic motivation.

Keywords: self-determination theory, academic performance, intrinsic motivation, extrinsic motivation, amotivation.

Introduction

Motivation studies are fundamentally concerned with investigating what “moves” someone to start, continue, and stop specific actions and/or tasks. Self-determination theory (*SDT*), identified as one of the main theories of human motivation, is based on the assumption of the inherent needs of autonomy, competence, and relatedness of humans, from which natural tendencies for growth, learning, and connection with others follow (Ryan & Deci, 2020).

SDT advocates the existence of a *continuum* in which three main types of motivation are identified according to the degree of influence of self-determination. In this case, intrinsic motivation refers to involvement in actions and/or tasks for inherent satisfaction, while extrinsic motivation is instrumental, that is, it explains actions and/or tasks performed for external or internal reasons, which can be allocated to one of four regulations: external, introjected, identified, and integrated. The first two regulations of extrinsic motivation (external and introjected) are also called controlled motivation, as they are predominantly controlled by external stimuli. In contrast, identified and integrated regulations fall under autonomous motivation, along with intrinsic motivation, in which one has the feeling of self-control over actions and/or behaviors. Amotivation refers to the reduced intention to engage in goal-directed behaviors, reflecting the absence of intrinsic and extrinsic motivation to engage in specific actions and/or behaviors (Ryan & Deci, 2017).

In the context of teaching, *SDT* can be applied to identify, understand, and promote the desire to learn and improve students' academic performance. As demonstrated in previous studies, intrinsic motivation tends to lead to higher quality learning, deeper understanding, better academic performance (Steinmayr et al., 2019), greater autonomy, more efficient competence (Okada, 2023), and a reduction in dropout rates (Hardre & Reeve, 2003).

Academic motivation based on *SDT* has been monitored recurrently through the Academic Motivation Scale (*AMS*), created in the late 1980s and originally designed for use with high school students (Vallerand et al., 1989). However, the scale was later adjusted for use by university students as well (Vallerand et al., 1993). The

AMS idealizers suggest interpreting intrinsic motivation as a multidimensional construct consisting of three different subscales: intrinsic motivation to knowledge, towards accomplishment, and to experience stimulation. Conceptually, intrinsic motivation to knowledge refers to the pleasure in learning new things, intrinsic motivation towards accomplishment has to do with the drive to achieve or create something new, and intrinsic motivation to experience stimulation is the subscale directed at the search for sensory stimulation during the activity. Regarding extrinsic motivation, for psychometric reasons the *AMS* also proposes three subscales, instead of the four defined in the *SDT*, with the subscale equivalent to integrated regulation being removed. Thus, the *AMS* consists of seven subscales: (1) intrinsic motivation to knowledge; (2) intrinsic motivation towards accomplishment; (3) intrinsic motivation to experience stimulation; (4) extrinsic motivation of external regulation; (5) extrinsic motivation of introjected regulation; (6) extrinsic motivation of identified regulation; and (7) amotivation. The psychometric properties of the *AMS* have been demonstrated in previous studies involving university students from different countries, including Brazil. The seven-subscale structure defined in the original theoretical model was later confirmed by subsequent confirmatory analyses, demonstrating satisfactory reliability, construct, and concurrent validity (Vallerand et al., 1993).

The traditional perspective of analyzing the scores produced by the *AMS* results from data equivalent to each of the seven subscales individually, and thus provides information to examine trends and average values of specific groups, denominated a variable-centered approach (kusurkar et al., 2021). However, according to the assumptions of the *AMS*, its subscales should not be restricted solely to the dissociated definition of the three types of motivation. That is, although the *SDT* clearly delineates the three types of motivation in the continuum of self-determination, the traditional perspective of analyzing the scores produced by the *AMS* leaves important individual differences hidden and does not contribute to a person-centered approach. Consequently, this approach prevents more detailed definitions of the broad spectrum of motivational profiles (intrinsically or extrinsically motivated, or amotivated). Therefore, in this particular case, to identify motivational profiles that align the *AMS* scoring system with the *SDT* and that allow the recognition of intra-group individual differences, a person-centered approach is necessary. The analysis of individual motivational characteristics enables us to explore complex relationships between variables within subgroups, and can reveal subtle patterns or interactions that are usually ignored in traditional variable-centered analyses (Howard & Hoffman, 2018).

Previous studies have been conducted that sought to test the *AMS* subscales to distinguish motivation profiles in samples of university students. One of these studies brought together Brazilian university students from the medical course and, through reinterpretation of the factorial structure of the *AMS*, initially combined the three subscales of intrinsic motivation with extrinsic motivation of identified regulation, followed by the subscales of extrinsic motivation of external regulation with extrinsic motivation of introjected regulation. Amotivation was treated separately in a third stratum. The findings indicated four motivational profiles; however, without clear alignment with the types of motivation specified by the *SDT* (Sobral, 2004). In two other studies the *AMS* was configured for the intrinsic motivation and controlled motivation subscales (extrinsic motivation of external and introjected regulations), while the extrinsic motivation subscales of identified regulation and amotivation were omitted. The results of both analytical approaches predetermined four motivational profiles and classified university students into: (a) high intrinsic motivation/high controlled motivation; (b) high intrinsic motivation/low controlled motivation; (c) low intrinsic motivation/high controlled motivation; and (d) low intrinsic motivation/low controlled motivation (Zalts et al., 2021; Shrestha & Pant, 2018).

On the other hand, academic burnout is a mental health construct related to studies, that is characterized by maladaptive psycho-emotional and physiological responses to chronic exposure to stressful events which can affect university students. In short, academic burnout causes university students to feel exhausted as a result of the demands of studying, to adopt cynical and detached attitudes, and to express a perception of incompetence to achieve objectives and goals in academic-professional training (Fiorilli et al., 2017). In this context, in recent years, high prevalence rates of academic burnout have been identified in the university populations of different countries (Kaggwa et al., 2021). Furthermore, previous studies suggest that academic stress significantly compromises the performance of university students in their studies and that academic motivation may be an important mediator of this condition (Trigueros et al., 2020; Alshareef et al., 2024).

In light of the freely reinterpreted analyses of the *AMS* and the possible interactions between academic motivation and academic burnout, the first objective of the current study was to identify distinct profiles of academic motivation using a person-centered approach, through cluster analysis, in a representative sample of Brazilian university students of physical education and physiotherapy. Next, considering the scarcity of research on this topic, the second objective was to verify the existing associations between the identified academic motivation clusters and signs suggestive of academic burnout.

Material and Methods

This is a cross-sectional study in which the procedures used were submitted to and approved by the Research Ethics Committee of the State University of Northern Paraná (Ethical approval statement number: 6,195,915/2023). The rights of all participants were safeguarded by means of a Free and Informed Consent Form signed prior to the start of data collection.

Population and sample

The reference population for the study included university students of the undergraduate courses in physiotherapy and physical education at the State University of Northern Paraná, Brazil (<https://uenp.edu.br/>), in the 2023 academic year. To illustrate the population universe addressed, according to information from the Academic Control Sector, at the beginning of the 2023 academic year there were records of 816 university students enrolled in both courses. The inclusion of university students in the sample occurred according to their desire to participate in the study. To this end, all university students enrolled and regularly attending physiotherapy and physical education courses offered by the University in 2023 were contacted and invited to participate in the study.

The criteria adopted for excluding any university student belonging to the study population were: (a) absence from classes on the day scheduled to carry out the invitation to participate in the study and data collection; (b) refusal to participate in the study; (c) any health problem that could prevent, temporarily or permanently, the university student from participating in data collection; (d) non-confirmation by signing the Free and Informed Consent Form; (e) being subjected to any specific medical treatment; (f) using any type of medication that could induce changes in the study variables; (g) being subjected to any type of diet; (h) pregnancy; (i) failure to adequately complete the measuring instrument; and (j) aged under 18 or over 35 years.

Measuring instrument and data collection procedure

Data were collected in August and September 2023 by a team of researchers familiar with the instrument and trained in its procedures, through a self-report survey consisting of three sessions: (a) demographic and academic indicators; (b) Academic Motivation Scale (*AMS*); and (c) Burnout Assessment Tool – Core Symptoms Short Version (*BAT-C*).

To complete the survey, all classrooms with classes consisting of undergraduate courses in physiotherapy and physical education at the university were visited, and the objectives of the research and the principles of confidentiality, non-identification in the study and non-influence on academic performance were explained to the university students. Subsequently, the university students were invited to participate in the study and those who initially agreed received a copy of the survey with instructions and recommendations for self-completion, with no time limit set for completion. Any questions raised by the respondents were promptly clarified by the researchers who monitored the data collection. After completing the survey, the respondents placed the document in a box together with all the other surveys, thus ensuring anonymity.

Study variables

The demographic and academic indicators session consisted of standardized items on gender (female/male), age (≤ 20 years/21-25 years/ ≥ 26 years), course (physical education/physiotherapy), shift (daytime and evening), and year of study (1st year/2nd and 3rd years/ ≥ 4 th year).

The *AMS* proposes to analyze motivational orientations in the context of academic-professional training, covering 28 items, divided into seven subscales (four items in each scale): three correspond to the type of intrinsic motivation; another three subscales incorporate the type of extrinsic motivation and, the last one, represents amotivation. The intrinsic motivation subscales cover: (a) intrinsic motivation to knowledge (doing something for the pleasure and satisfaction that comes from learning, exploring, or understanding); (b) intrinsic motivation towards accomplishment (doing something for the pleasure and satisfaction that comes from seeking to maximize the execution of actions or tasks); and (c) intrinsic motivation to experience stimulation (doing something in order to experience sensations related to one's own sensory nature). On the other hand, the extrinsic motivation subscales include: (d) extrinsic motivation of identified regulation (doing something because one has decided to do it); (e) extrinsic motivation of introjected regulation (doing something because one is pressured to do it); and (f) extrinsic motivation of external regulation (doing something because one feels pressured by others to do it). Furthermore, the concept of amotivation implies the absence of perception of contingencies between actions and their outcomes (lack of intrinsic or extrinsic motivational stimuli). Each item is scored using a *Likert* scale, ranging from 1 (no correspondence) to 7 (total correspondence), with a midpoint of 4 (moderate correspondence). The university student indicates the alternative that best matches their agreement with the statement, which allows the calculation of the score of each motivation subscale based on the average of the items linked to the proposed theoretical construct. It is not suggested that any overall academic motivation score be calculated using the *AMS* (Vallerand et al., 1993).

The *BAT-C* aims to identify signs suggestive of academic burnout based on the frequency with which the personal feelings and attitudes of the university student are experienced in relation to studies and the academic environment in general. The measurement scale consists of 12 items distributed in four dimensions, that encompass the main symptoms of academic burnout: (a) exhaustion (feeling of mental and physical tiredness and fatigue); (b) distancing from studies (feeling of distance from study-related activities); (c) cognitive impairment (difficulty concentrating and paying attention when studying); and (d) emotional commitment (difficulty managing emotional regulation). All items are scored on a five-point Likert scale: 1 (“never”); 2 (“rarely”); 3 (“sometimes”); 4 (“often”); and 5 (“always”). The signs suggestive of academic burnout are measured by the

arithmetic mean of the scores attributed to the 12 items, which is conventionally called the global academic burnout index (Schaufeli, De Witle & Desart, 2023).

The survey was completed in a single session, individually by each participant, at the same time as the class. The average time for self-completion was approximately 25 minutes. The reliability of the survey was analyzed by replicating it over seven days with 10% of the university students selected for the study. All items presented a *Cohen's* concordance index ≥ 0.78 .

Data analysis

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) computerized package, version 29. Initially, the frequency distribution of the scores attributed to the *AMS* subscales and the *BAT-C* dimensions was tested using the Kolmogorov-Smirnov test. Considering that the data showed normal frequency distribution, parametric statistic resources were used, through calculations of mean and standard deviation. Subsequently, to establish comparisons between the strata formed, multivariate (*MANOVA*) and univariate (*ANOVA*) analyses of variance were used, with the *AMS* subscales as dependent variables and gender, age, and data from the university environment as independent variables, accompanied by the Bonferroni multiple comparison post hoc test to locate specific differences. The partial eta-squared (η^2p) was calculated to analyze the effect size.

To identify specific academic motivation profiles using a person-centered approach with data from the seven *AMS* subscales, cluster analysis procedures were used. To this end, the analysis was divided into two stages in which a combination of algorithms for hierarchical and non-hierarchical groupings was applied. In the first stage, hierarchical cluster analysis was performed using Ward's method, based on Euclidean distances as a measure of dissimilarity between university students.

To reduce the sensitivity of Ward's method to outliers, univariate outlier scores (values ≥ 3 standard deviations lower or higher than the respective mean) and multivariate outliers (those with a high distance from Mahalanobis values) for any of the seven subscales investigated were removed prior to analysis. In this phase, a comparison of several possible clustering solutions was performed. Using the resulting centroids, a non-hierarchical k-means cluster analysis was performed to refine the preliminary hierarchical clustering solution. To examine the stability of the derived cluster solutions, the sample was randomly divided into two halves and the full two-step procedure (Ward, followed by k-means) was applied to each half. Elements from each half of the sample were assigned to a new cluster based on their Euclidean distances to the cluster centers of the other half of the sample. These new clusters were then compared for agreement with the original clusters using Cohen's kappa (κ). The agreement was excellent (0.927).

To compare the characteristics of the cluster solution, one-way analysis of covariance adjusted for gender, age, and academic environment data was used. Bonferroni's multiple comparison post hoc test was used to locate specific differences.

The associations between the academic motivation profiles defined by the cluster solution and the signs suggestive of academic burnout were identified through odds ratio values accompanied by 95% confidence intervals, calculated by binary logistic regression with adjustments for gender, age, and data from the university environment. To this end, considering the lack of criteria to identify signs suggestive of academic burnout, the sample was dichotomized based on the distribution of tercil, according to cut-off points of scores equivalent to the global academic burnout index. The group at greatest risk for the presence of signs suggestive of academic burnout included university students with scores above the 3rd tercil

Results

A sample of 497 participants from a universe equivalent to 816 university students from both courses completed the survey, resulting in a response rate of 61%. Women represented 63.2% of the study participants and 42.5% were between 21 and 25 years of age. Regarding the university environment, the university students participating in the study were similarly distributed between the courses: physical education (45.5%) and physiotherapy (54.5%), and between the 1st year (26.2%) and the 4th year (23.7%); however, twice as many students attended classes in the evening (66.2%).

Table 1 presents the results of the statistical analysis of the *AMS* subscales according to gender, age, and data from the university environment. Indications gathered by *MANOVA* suggest that the motivation subscales scored by university students presented significant differences between gender (Wilks' $\lambda = 0.933$; $F(7,489) = 5.012$; $p < 0.001$; $\eta^2 = 0.047$) and age (Wilks' $\lambda = 0.924$; $F(14,976) = 1.847$; $p = 0.011$; $\eta^2 = 0.026$). In this regard, it was found that women scored significantly higher in the subscales of intrinsic motivation to knowledge ($p = 0.004$), towards accomplishment ($p = 0.011$), and to experience stimulation ($p = 0.023$), and extrinsic motivation of identified regulation ($p = 0.027$), while higher scores of extrinsic motivation of external regulation ($p = 0.031$) and amotivation ($p = 0.013$) were reported by men. Regarding age, older university students presented higher scores equivalent to the three subscales of intrinsic motivation: knowledge ($p = 0.026$), accomplishment ($p = 0.022$), and experience stimulation ($p = 0.008$), and the subscale of extrinsic motivation of identified regulation ($p = 0.031$).

Table 1. Multivariate and univariate analyses of scores equivalent to the academic motivation subscales of Brazilian university students of physical education and physiotherapy according to gender, age, and data from the university environment

	Intrinsic Motivation			Extrinsic Motivation			
	Knowledge	Accomplishment	Experience Stimulation	Identified	Introjected	External	Amotivation
Total	5.46±1.13	4.74±0.93	4.04±0.90	5.78±1.08	5.03±0.98	5.34±1.02	1.97±1.03
Gender	Multivariate Analysis: Wilks' $\lambda = 0.933$; $F(7,489) = 5.012$; $p < 0.001$; $\eta^2 = 0.047$						
Women	5.65±1.07	4.92±0.86	4.20±0.84	5.94±1.09	5.10±1.10 ^a	5.19±0.95	1.79±0.97
Men	5.13±1.22	4.43±1.02	3.76±0.99	5.51±1.13	4.91±0.89 ^a	5.60±1.11	2.28±1.02
Univariate Analysis	($p = 0.004$)	($p = 0.011$)	($p = 0.023$)	($p = 0.027$)	(ns)	($p = 0.031$)	($p = 0.013$)
Age	Multivariate Analysis: Wilks' $\lambda = 0.924$; $F(14,976) = 1.847$; $p = 0.011$; $\eta^2 = 0.026$						
≤ 20 years	5.21±1.29 ^a	4.53±1.04 ^a	3.69±0.94 ^a	5.32±1.06	4.81±0.95 ^a	5.25±1.09 ^a	1.84±0.91 ^a
21 – 25 years	5.48±1.10 ^{a,b}	4.69±0.90 ^a	3.93±0.98 ^a	5.80±1.10 ^a	4.95±1.02 ^a	5.32±0.92 ^a	1.97±0.96 ^a
≥ 26 years	5.80±0.96 ^b	5.20±0.82	4.43±0.97	5.81±1.13 ^a	5.12±1.00 ^a	5.41±1.03 ^a	2.04±1.08 ^a
Univariate Analysis	($p = 0.026$)	($p = 0.012$)	($p = 0.002$)	($p = 0.031$)	(ns)	(ns)	(ns)
Course	Multivariate Analysis: Wilks' $\lambda = 0.986$; $F(7,489) = 1.091$; $p = 0.351$; $\eta^2 = 0.015$						
Physical education	5.39±1.12 ^a	4.69±0.91 ^a	3.98±0.87 ^a	5.72±1.11 ^a	4.90±0.96 ^a	5.42±1.07 ^a	1.98±1.02 ^a
Physiotherapy	5.54±1.15 ^a	4.81±0.97 ^a	4.11±0.94 ^a	5.85±1.14 ^a	5.19±1.05 ^a	5.24±0.97 ^a	1.95±1.03 ^a
Univariate Analysis	(ns)	(ns)	(ns)	(ns)	(ns)	(ns)	(ns)
Study shift	Multivariate Analysis: Wilks' $\lambda = 0.973$; $F(7,489) = 1.931$; $p = 0.063$; $\eta^2 = 0.027$						
Daytime	5.34±1.14 ^a	4.63±0.91 ^a	3.95±0.87 ^a	5.71±1.10 ^a	5.11±1.00 ^a	5.48±1.06 ^a	2.01±1.05 ^a
Evening	5.50±1.13 ^a	4.78±0.94 ^a	4.07±0.92 ^a	5.82±1.18 ^a	4.96±0.91 ^a	5.27±0.98 ^a	1.95±0.99 ^a
Univariate Analysis	(ns)	(ns)	(ns)	(ns)	(ns)	(ns)	(ns)
Study year	Multivariate Analysis: Wilks' $\lambda = 0.966$; $F(14,976) = 2.471$; $p = 0.017$; $\eta^2 = 0.034$						
1 st year	5.71±1.20 ^a	4.95±0.95 ^a	4.23±0.97 ^a	5.96±1.13 ^a	4.85±0.93 ^a	5.20±0.98 ^a	1.72±0.86 ^a
2 nd and 3 rd years	5.43±1.14 ^{a,b}	4.73±0.91 ^{a,b}	4.05±0.94 ^a	5.81±1.10 ^{a,b}	5.03±0.97 ^{a,b}	5.31±1.01 ^{a,b}	1.98±1.01 ^{a,b}
4 th year	5.24±1.09 ^b	4.54±0.89 ^b	3.82±0.91	5.46±1.09 ^b	5.22±1.03 ^b	5.62±1.07 ^b	2.21±1.05 ^b
Univariate Analysis	($p = 0.028$)	($p = 0.043$)	($p = 0.041$)	($p = 0.021$)	($p = 0.044$)	($p = 0.039$)	($p = 0.030$)

F statistic after controlling for the other independent variables in the model.

Scores subscripted by the same letters indicate statistical similarities between the strata ($p < 0.01$).

With regard to the university environment, year of study was the only factor addressed that revealed a significant effect on the scores of the motivation subscales attributed by university students (Wilks' $\lambda = 0.966$; $F(14,976) = 2.471$; $p = 0.017$; $\eta^2 = 0.034$). In this case, scores relating to the subscales of more controlled motivation: extrinsic motivation of introjected regulation ($p = 0.044$) and external regulation ($p = 0.039$), in addition to the amotivation subscale ($p = 0.030$) increased in parallel with advancing age, in the same proportion as the scores relating to the autonomous motivation subscales: intrinsic motivation to knowledge ($p = 0.028$), towards accomplishment ($p = 0.043$), and to experience stimulation ($p = 0.041$), and extrinsic motivation of identified regulation ($p = 0.021$), were significantly reduced in university students with more years of study.

Regarding the mean, standard deviation, and tercil distribution values equivalent to the *BAT-C* scores, the dimension related to exhaustion (3.28 ± 0.97) was the one that presented a significantly higher mean score and, in turn, it tended to offer a greater contribution to the definition of the global academic burnout index (2.85 ± 0.75). In contrast, the dimension related to emotional impairment (2.44 ± 1.01) presented a significantly lower mean score. The dimensions related to distancing from studies (2.65 ± 0.88) and cognitive impairment (2.94 ± 0.92) presented statistically similar mean values. Based on the tercil distribution of scores equivalent to the global academic burnout index, the group at greatest risk for the presence of signs suggestive of academic burnout (scores above the 3rd tercil) was defined as university students with scores ≥ 3.13 .

A two-stage cluster analysis was performed to identify specific academic motivation profiles using data from the seven *AMS* subscales. As a result, three clusters were generated with different coexistence configurations and individual engagement gradients of the motivation subscales – Figure 1. The average Silhouette coefficient equivalent to 0.39 indicated quite distinct clusters. Cluster 1 (high self-determination) grouped university students who scored higher on the subscales of extrinsic motivation of identified regulation, followed by the subscales of intrinsic motivation to knowledge and accomplishment, together with lower scores equivalent to extrinsic motivation of external regulation and amotivation.

University students grouped in cluster 2 (moderate self-determination) recorded higher scores in the three intrinsic motivation subscales: accomplishment, experience stimulation, and knowledge, accompanied by lower scores in the extrinsic motivation of introjected regulation subscale. The highest score given to the amotivation subscale, accompanied by lower scores given to the three intrinsic motivation subscales: knowledge, accomplishment and experience stimulation, and the extrinsic motivation of identified regulation subscale represented university students grouped in cluster 3 (low self-determination).

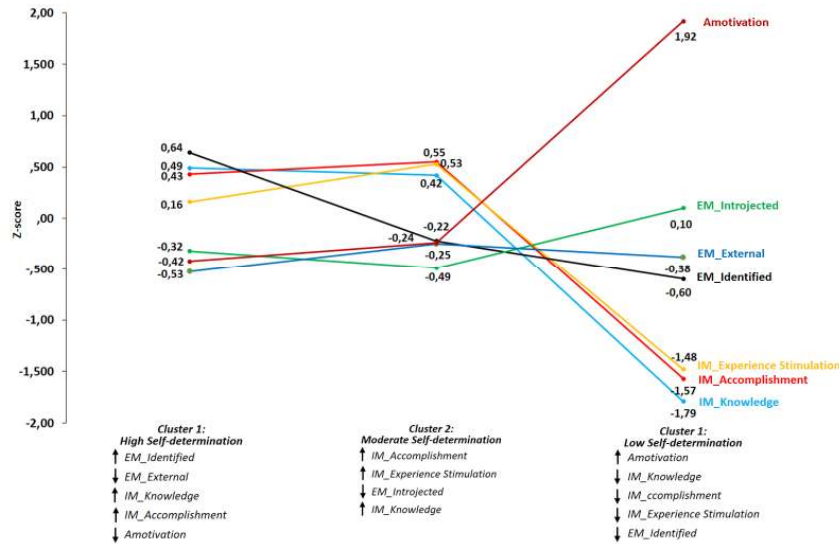


Figure 1. Cluster solutions and mean z-scores of academic motivation subscales of Brazilian university students of physical education and physiotherapy.

The proportions of university students in each cluster according to gender, age, year of study, and the differences between the characteristics of the cluster solutions are described in Table 2. At this moment, data from the university environment regarding the course and study shift were not considered because the *MANOVA* did not indicate a significant effect on the scores of the motivation subscales attributed by university students. The cluster defined by high self-determination tended to group a higher proportion of women, while the cluster defined by moderate self-determination included a higher proportion of men. Regarding age, similar proportions of university students were distributed across the three clusters. However, the cluster defined by high self-determination accumulated a greater proportion of university students in the first year of study, while the cluster defined by low self-determination grouped a greater proportion of university students in the final year of study.

Comparisons between the cluster solutions indicated significant differences in specific academic motivation subscale scores. In the high self-determination cluster, the mean scores for extrinsic motivation of identified and external regulation were significantly higher than in the other two clusters. The low self-determination cluster consisted of university students who, on average, scored the lowest equivalent scores on the intrinsic motivation subscales (knowledge, accomplishment, and experience stimulation) and, in turn, the highest scores on the subscale related to amotivation. Furthermore, in the moderate self-determination cluster, the average scores demonstrated statistical similarities with the scores found in the intrinsic motivation and amotivation subscales of the high self-determination cluster and, similarly, with the scores found in the extrinsic motivation subscales of the low self-determination cluster.

Table 2. Proportions of university students in each cluster according to gender, age, and differences between the characteristics of the cluster solutions

	n(%)	Self-determination		
		High (Cluster 1)	Moderate (Cluster 2)	Low (Cluster 3)
Gender				
Women (n = 314)		124 (39.5%)	152 (48.4%)	38 (12.1%)
Men (n = 183)		46 (25.1%)	112 (61.2%)	25 (13.7%)
Age				
≤ 20 years (n = 99)		36 (36.4%)	49 (49.5%)	14 (14.1%)
21 – 25 years (n = 211)		76 (36.0%)	105 (49.8%)	30 (14.2%)
≥ 26 years (n = 187)		69 (36.9%)	92 (49.2%)	26 (13.9%)
Study year				
1 st year (n = 130)		54 (41.5%)	61 (46.9%)	15 (11.6%)
2 nd and 3 rd years (n = 249)		92 (36.9%)	127 (51.0%)	30 (12.1%)
4 th year (n = 118)		40 (33.9%)	57 (48.3%)	21 (17.8%)
Intrinsic motivation to knowledge		5.96 ± 1.15 ^a	5.89 ± 1.19 ^a	3.62 ± 0.85
Intrinsic motivation towards accomplishment		5.14 ± 1.02 ^a	5.25 ± 1.07 ^a	3.28 ± 0.74
Intrinsic motivation to experience stimulation		4.15 ± 0.91 ^a	4.52 ± 1.01 ^a	2.71 ± 0.65
Extrinsic motivation of identified regulation		6.46 ± 1.22	5.62 ± 1.12	5.01 ± 1.19
Extrinsic motivation of introjected regulation		4.71 ± 0.95 ^a	5.51 ± 1.09 ^b	5.10 ± 1.21 ^{a,b}
Extrinsic motivation of external regulation		6.18 ± 1.13	5.39 ± 0.98 ^a	5.25 ± 1.01 ^a
Amotivation		1.54 ± 0.92 ^a	1.72 ± 0.98 ^a	3.96 ± 1.12

ANCOVA controlling for gender, age, and year of study.

Values subscripted by the same letters indicate statistical similarities between clusters ($p < 0.01$).

The associations between the derived clusters and the signs suggestive of academic burnout identified through information produced by the logistic regression analysis are presented in Table 3. The high self-determination cluster was selected as the reference cluster because it brings together the most autonomous motivation subscales. University students grouped in the low self-determination cluster demonstrated a two and a half times greater chance of presenting signs suggestive of academic burnout than their peers in the reference cluster (OR = 2.48 [95%CI 1.61 – 4.36], $p < 0.001$). In the case of university students grouped in the moderate self-determination cluster, the chances of showing signs suggestive of academic burnout were not significantly different compared to their peers grouped in the high self-determination cluster (OR = 1.52 [95%CI 0.98 – 2.74], $p = 0.053$).

Table 3. Association between academic motivation clusters and signs suggestive of academic burnout.

Clusters	Odds Ratio	95%CI	p-values
High self-determination	Reference		
Moderate self-determination	1.52	0.98 – 2.74	0.053
Low self-determination	2.48	1.61 – 4.36	< 0.001

Odds ratio values calculated by adjusting for gender, age, and year of study.

Discussion

The current study was designed to identify distinct profiles of academic motivation using a person-centered approach through cluster analysis and the potential associations between the identified clusters and signs suggestive of academic burnout in a representative sample of university students of physical education and physiotherapy. To our knowledge, this study is the first to address the issue in the Brazilian university population; therefore, it adds new knowledge to the literature and provides important support for the design of more effective interventions aimed at the well-being and improvement of the academic performance of university students.

The data showed that, regardless of gender, age, and items selected from the academic environment, the most prevalent academic motivation subscale among university students was the extrinsic motivation of identified regulation. Furthermore, the university students analyzed herein reported receiving significant intrinsic influence on their academic motivation and being minimally influenced by amotivation. These findings are consistent with the results of previous studies conducted with the participation of university students from different courses in the health area (Zalts et al., 2021; Shrestha & Pant, 2018). In a way, this perhaps reinforces the assumption that university students in the health field from different backgrounds and cultures share similar motivational attitudes, as they may be more oriented towards their studies and future professional careers.

Based on the seven academic motivation subscales detected by the *AMS*, and through cluster analysis, three academic motivation profiles emerged. The high self-determination profile indicated higher scores in the extrinsic motivation subscales (identified and external regulations), and intrinsic motivation (knowledge and accomplishment), and lower scores in the amotivation subscale. In turn, the moderate self-determination profile highlighted scores equivalent to the three intrinsic motivation subscales (knowledge, accomplishment, and experience stimulation) and the extrinsic motivation subscale of introjected regulation. The main characteristics of the low self-determination profile were the highest score on the amotivation subscale, combined with the lowest scores on the three intrinsic motivation subscales, and the extrinsic motivation of identified regulation.

The presence of the extrinsic motivation of identified regulation, a more self-determined form of extrinsic motivation, with a relatively high score (5.01 ± 1.19) in the low self-determination profile, may initially be understood as an incongruent finding. However, a similar result was observed in a previous study with the participation of university students from the medical course (Oláh, Münnich & Kósa, 2023), furthermore, the other two academic motivation profiles identified in the current study implied significantly higher mean extrinsic motivation of identified regulation scores. In addition, although identified regulation was the dominant extrinsic motivation subscale in the high and moderate self-determination profiles, the mean score of this subscale in the low self-determination cluster did not exceed the scores of the extrinsic motivation of introjected and external regulation subscales.

Thus, and supported by the average Silhouette coefficient found (0.39), the three motivational profiles revealed by the cluster analysis can be considered well differentiated, which allows the positioning of university students on the *SDT* continuum with 'low', 'moderate', or 'high' levels of self-determination of academic motivation. In this case, 13.9% of the physical education and physiotherapy university students in our sample fell into the low self-determination profile, demonstrating a notable level of amotivation, more than half (51.9%) into the moderate self-determination profile, and, approximately, one in every group of three university students (34.2%) was allocated to the high self-determination profile.

Comparisons between the current findings and results from previous studies are limited due to the different methodologies employed. For example, in studies involving European university students (Zalts et al., 2021) and Asians (Shrestha & Pant, 2018), participants were grouped into four predefined strata based on combinations of low/high intrinsic/extrinsic motivation scores. In contrast, in the present study it was decided

not to define the number of possible strata in advance and, therefore, through cluster analysis, three distinct profiles consistent with the *SDT* were identified. In any case, the sample of European university students showed a higher proportion of those who were more intrinsically and extrinsically motivated (25.2%), followed by those who were motivated predominantly by extrinsic factors (31.8%), then by those who were mainly intrinsically motivated (26.1%) and, finally, by those with low academic motivation (16.9%). In the Asian sample, the largest proportion of university students self-reported being intrinsically and extrinsically motivated (36.1%), followed by those who demonstrated low academic motivation (23.8%). On the other hand, a previous study in which cluster analysis procedures were similarly used to define groups of university students in the academic motivation subscales showed results somewhat similar to the findings of the present study; however, the authors grouped a greater proportion of university students in the moderate self-determination cluster (58.7%) and slightly smaller proportions in the high (31.2%) and low (10.1%) self-determination clusters (Oláh, Münnich & Kósa, 2023).

Gender and year of study of the university students influenced the cluster solutions that combined the academic motivation subscales. These findings allow us to identify subgroups of the university population with a less autonomous motivational profile, thus supporting the targeting of more appropriate intervention actions to the segments of greatest exposure. In this context, a higher proportion of men was observed in the moderate self-determination cluster, while a higher proportion of women was identified in the high self-determination cluster. Although the academic motivation scale used in some studies may differ from that used in the current study, similar findings are identified in reports of surveys conducted with university students from different countries (Zalts et al., 2021; Shrestha & Pant, 2018; Kusnierz, Rogowska & Pavlova, 2020; Oláh, Münnich & Kósa, 2023). Reasons that could support this finding are unclear; however, evidence has shown that parental and family support is positively related to academic motivation, particularly with regard to the intrinsic motivation subscales (Kunanithaworn et al., 2018). Furthermore, positive parental considerations are associated with support for university students' autonomy (Wu et al., 2020). In this particular case, considering that women tend to be closer to family members (Boontarika & Kusakabe, 2013), which is observed in different cultures (Campos et al., 2014; Sivrikaya, 2019), their levels of self-determination are expected to be higher.

Regarding the year of study, supported by data made available in previous surveys (Sarkis et al., 2020; Kusnierz, Rogowska & Pavlova, 2020), the study findings indicated a higher proportion of university students studying in the first year of university in the high self-determination cluster, while university students in the final year of study were clustered in greater numbers in the low self-determination cluster. However, it is important to highlight that, contrary to this trend, a study involving physiotherapy university students did not find significant differences between the academic motivation subscales as the years of study progressed (Selvakumar, Xian & Ilayaraja, 2022). A study conducted in Brazil also showed that university students, specifically medical students, tended to present higher scores on autonomous motivation subscales in the initial semesters of their training course. However, they also presented higher scores on the extrinsic motivation of external regulation and amotivation subscales in later years (Silva et al., 2018). This finding can be attributed to the impact of the training curricula for future professionals adopted by colleges, the teaching models used by university professors, and the learning strategies adopted by university students. In fact, students have inherent characteristics when they enter university education, but they may become less intrinsically stimulated if training curricula and teaching models are excessively theoretical, distancing themselves from the contextualization of future professional performance (Alshareff et al., 2024). Furthermore, an important study described a possible decline in "idealism" (empathy and idealistic motivations) in university students in their final years of study, showing motivational changes related to lifestyle, financial issues, and career and professional prestige (Morley et al., 2013). Although "idealism" and "motivation" present different conceptions, the motivational changes described in the study refer to variables that are correlated with lower levels of self-determination, such as lifestyle, financial issues, and professional prestige. Furthermore, academic exhaustion, which may accumulate as the years of study progress, can have a substantial influence on the decline in self-determination of university students in the final years of their studies (Vidhukumar & Hanza, 2020).

Regarding the link between motivation profiles and signs suggestive of academic burnout, it was found that university students grouped in the low self-determination cluster, translated by the highest score on the amotivation subscale, combined with lower scores on the three intrinsic motivation subscales and the extrinsic motivation of identified regulation, demonstrated greater chances of manifesting signs suggestive of academic burnout. This finding is the first to demonstrate the association between motivation and academic burnout, which corroborates the hypothesis that the joint influence of groupings of academic motivation subscales goes beyond the academic-professional training process, also becoming an important concern for university managers regarding the impact on the mental health and well-being of university students.

Indeed, previous studies have consistently reported negative associations between academic burnout and engagement, self-efficacy, self-esteem, and positive coping strategies (Romano et al., 2021; Özhan, 2021). Similarly, academic burnout is positively associated with detachment and cynicism in the university context (Romano et al., 2020). Furthermore, other findings indicated that university students with signs suggestive of academic burnout tend to be at high risk of developing eating disorders and sleep disorders (Naderri et al., 2021), the use of harmful substances (Nagy et al., 2019) and, fundamentally, mental health problems (Fiorilli et al.,

2019). In this same direction, previous studies have shown that when autonomous motivation is predominant, dedication and commitment to academic tasks increase, learning is more effective, and, consequently, academic performance increases, with a lower perception of exhaustion and burnout (Zalts et al., 2021; Teuwen et al., 2024). Regarding mental health, evidence available in the literature indicates that university students with low self-determination or who are unmotivated are more exposed to the outcomes of psychological suffering (Mahdavi et al., 2023) and lower life satisfaction (Salinas-Jiménez et al., 2010). Therefore, the presence of academic burnout in university students can seriously threaten their career and the opportunity to complete the academic cycle in a positive way.

An important consideration in interpreting these results is that the directionality of the association cannot be assumed. Thus, although it is logical to interpret the data from the current study as meaning that university students with low self-determination may be more exposed to academic burnout, it is equally plausible to assume that university students identified with signs suggestive of academic burnout will, as a consequence, present low self-determination. Alternatively, other variables (not considered in the current study) may contribute to this association. For example, university students who are more susceptible to burnout and exhaustion when faced with academic tasks and obligations may also, because of this susceptibility, adopt a less self-determined motivational stance. Furthermore, academic fatigue and exhaustion, as measured here by signs suggestive of burnout, may reflect causes beyond the everyday experience of university physical education and physiotherapy courses. Significant life events, such as personal or family difficulties, may, to some extent, interact with the demands of the university course and compromise more self-determined motivation and the emergence of signs suggestive of academic burnout. These distinctions should be kept in mind when interpreting the findings presented herein.

Conclusions

In conclusion, in order to identify specific issues and design more effective intervention actions, the cluster analysis generated three distinct profiles of academic motivation, with different coexistence configurations and gradients of individual engagement of the seven *AMS* subscales, namely clusters of high, moderate, and low self-determination. Regarding the association between motivation and academic burnout, university students in the low self-determination cluster showed greater exposure to signs suggestive of academic burnout. The practical implication of the current study is the possibility that screening and monitoring strategies that simultaneously address the autonomous, controlled, and amotivation subscales present potentially more effective effects than strategies targeting each subscale in isolation.

However, it is essential to highlight that the study's conclusions are subject to some limitations. Above all, the cross-sectional design employed does not allow for the identification of a causal link between the outcomes, so the findings should be considered with some caution. Future studies should be conducted with a long-term longitudinal design to examine the causal relationships between motivation and academic burnout. Voluntary participation may also have introduced selection bias by suggesting that more motivated university students would be more willing to participate in the data collection. In addition, the research method involves a survey of self-reported responses, which is inherently subject to possible bias from biased statements or convenience in the direction of the desirable. Finally, the diagnostic criterion for signs suggestive of academic burnout was based on the tercile distribution, which may present potential deviations.

Conflict of interest: The authors declare no conflict of interest.

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