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Stress and Cognitive Appraisal in University Students: Explaining Burnout Over Time

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A B S T R A C T

This study explored the experience of students' burnout across time, aiming to analyze the possible differential impact of stress and cognitive appraisal on burnout. In addition, it investigated the possible mediation effect of cognitive appraisal on the relationship between stress and burnout. The study included 175 university students aged between 17 and 42 years old ($M = 21.19$ years; $SD = 3.95$), of which 155 were female (89%) and 18 were male (10%). We collected data in three different moments (Mt) through the following evaluation protocol: Mt1 included a Sociodemographic Questionnaire, the Student Stress Questionnaire, the Cognitive Appraisal Scale, and the Reduced COPE inventory; Mt2 and Mt3 included the Shirom-Melamed Burnout Measure. We used structural equation modeling analysis to test the hypotheses. The structural models tested indicated that the partial mediation model presented the best-fit indices, showing that stress and cognitive appraisal were predictors of burnout and that cognitive appraisal mediated that relationship. In sum, the results confirm the dynamic and chronic effect of academic stress on the experience of burnout over time. So, students and educators should be aware of academic stressors and pedagogical and life skills training programs implemented to provide better coping strategies to control burnout experiences.

Estrés y valoración cognitiva en estudiantes universitarios: Explicación del Burnout a lo largo del tiempo

R E S U M E N

Este estudio exploró la experiencia del burnout de los estudiantes a lo largo del tiempo, con el objetivo de analizar el posible impacto diferencial del estrés y la valoración cognitiva sobre el burnout. Además, se investigó el posible efecto mediador de la valoración cognitiva en la relación entre estrés y burnout. En el estudio participaron 175 estudiantes universitarios con edades comprendidas entre los 17 y los 42 años ($M = 21,19$ años; $DT = 3,95$), de los cuales 155 eran mujeres (89%) y 18 hombres (10%). Recogimos datos en tres momentos diferentes (Mt) mediante el siguiente protocolo de evaluación: Mt1 incluyó un Cuestionario Sociodemográfico, el Cuestionario de Estrés del Estudiante, la Escala de Valoración Cognitiva y el inventario COPE Reducido; Mt2 y Mt3 incluyeron la Medida de Burnout de Shirom-Melamed. Se utilizó el análisis de modelos de ecuaciones estructurales para probar las hipótesis. Los modelos estructurales probados indicaron que el modelo de mediación parcial presentaba los índices de mejor ajuste, mostrando que el estrés y la valoración cognitiva eran predictores del burnout y que la valoración cognitiva mediaba esa relación. En resumen, los resultados confirman el efecto dinámico y crónico del estrés académico sobre la experiencia del burnout a lo largo del tiempo. Por lo tanto, los estudiantes y los educadores deben ser conscientes de los estresores académicos e implementar programas pedagógicos y de formación en habilidades para la vida que proporcionen mejores estrategias de afrontamiento para controlar las experiencias de burnout.

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Stress and Cognitive Appraisal in College Students: Explaining Burnout Over Time

Entering university involves adapting the student to the academic environment, which can be a critical period in the student's life until a point that can precipitate the onset of mental health problems (King et al., 2021; Pitt et al., 2018). Students' prolonged exposure to several stressors can trigger the development of mental health problems (Pedrelli et al., 2015), such as anxiety and depression (Duffy et al., 2020; Shao et al., 2020) and even burnout syndrome (Jiménez-Ortiz et al., 2019; Lin & Huang, 2014).

The literature has highlighted the relevance of research on stress adaptation in higher education students, given that they present higher levels of stress when compared to their non-student peers (Jordan et al., 2020; Stallman, 2010). However, not all students feel that their academic activity (e.g. being a student) is potentially stressful or generates physical and psychological problems (Frazier et al., 2018). Stress arises when students perceive their personal and social resources as insufficient to deal effectively with the new challenges imposed by the environment (Lazarus, 1991). Therefore, research has focused on understanding the individual process of human adaptation to stress, considering the cognitive appraisal processes that determine how the individual evaluates the situation (Gomes, 2014; Lazarus & Folkman, 1984). In this way, the central purpose of this paper is to provide an integrated understanding of stress adaptation in university students by addressing the relationship between the potential stressors of the academic environment, the cognitive appraisal processes involved, and the relationship with the emergence of burnout. To understand the importance of cognitive appraisal in this process, we used a longitudinal perspective to capture the dynamic experience of stress, cognitive appraisal, and burnout. From a theoretical point of view, the understanding of this adaptation process relies on the transactional perspective of adaptation to stress (Lazarus, 1991). According to this perspective, stress results from the transaction between individual and environmental factors - a transaction where cognitive appraisal processes, at the primary and secondary levels, have significant determinant influence (Lazarus, 1991). The primary cognitive appraisal consists of the first impact between individuals and the stressful event, referring to the personal meaning they attach to it (Lazarus & Folkman, 1984). This appraisal only occurs when the event is previously considered important by the person; otherwise, it does not represent a stressful experience (Gomes, 2014). So, when individuals feel able to cope with the event, they tend to experience feelings of challenge, but, on the contrary, when they have difficulties dealing with the demands the situation imposes, they tend to experience feelings of threat (Lazarus, 1999).

Once individuals have interpreted the situation, the secondary cognitive appraisal processes take over, consisting of managing the stressful situation (Gomes, 2014; Lazarus, 1991). This phase counts with the insertion of coping mechanisms, which embrace the cognitive and behavioral strategies individuals develop when facing a potentially stressful situation (Lazarus & Folkman, 1984). These strategies can assume different categorizations, but it is usual to divide them into problem-solving-focused strategies (i.e., active coping) and emotional regulation-focused strategies, which can assume a more active (e.g., humor) or a passive way (e.g., denial; Folkman & Lazarus, 1985). The literature points out that active strategies, such as active coping and humor, assume an adaptive function in individuals' responses. In contrast, passive strategies, centered on avoidance and denial of the situation, assume a non-adaptive role (Coyne & Racioppo, 2000; Deasy et al., 2014) and may thus result in adverse effects on individuals (Gibbons, 2010).

Even so, the literature points to a fourth area of coping: strategies focused on social support (i.e., emotional support; Folkman & Lazarus, 1985).

A key aspect of understanding the adaptation to stress relates to the variables' status assumed in research. Some studies have examined the relationships between stress and how students feel in stressful situations, such as anxiety, depression (Arusha & Biswas, 2020; Wong et al., 2006) and burnout (Jordan et al., 2020). Some other studies focus on the relationships between cognitive appraisal processes and how students feel in stressful situations (Frazier et al., 2018). An example provided by Lepine et al. (2004) demonstrates that students who evaluate stressful situations as challenging tend to have positive adaptive outcomes. On the other hand, students perceiving the situation as a threat may compromise their learning and performance. However, these studies do not consider the transactional relationship between the stimuli (i.e., stressors), how the person appraises it (i.e., mediating cognitive appraisal), and how they respond to those situations (i.e., consequences of stress). This aspect is fundamental to testing the importance of transactional and interactive models that have sought to study adaptation to stress (Blascovich & Mendes, 2000; Gomes, 2014; Lazarus, 1991). To this respect, some studies are testing the mediation effect of cognitive appraisal (Gibbons, 2010; Gomes et al., 2013), but there is still little evidence regarding the specific coping strategies students use in their process of adaptation to academic stress and, there are scarce findings about how stress and cognitive appraisal contribute to explain individuals' responses across time. In fact, there is a dearth of results in understanding how adaptation to stress occurs over time, causing the experience of burnout (Enns et al., 2018; Shah et al., 2010).

This investigation intends to fill this gap by studying the relations between stress, cognitive appraisal (primary and secondary), and burnout over time. Specifically, we aimed to perform an integrated analysis of the process of adaptation to stress by considering stress as the antecedent variable, the primary cognitive appraisal (i.e., threat and challenge perceptions), and the secondary cognitive appraisal processes (i.e., coping and control perceptions) as mediating variables; and, the burnout as the consequent variable. The authors chose burnout based on literature indications of its high prevalence in university students (Farrell et al., 2019; Muzafar et al., 2015) and its consequences on students' engagement and performance (Schaufeli et al., 2002). The concept of burnout refers to a psychological syndrome caused by the response to chronic emotional and interpersonal stressors at work (Maslach & Leiter, 2016), characterized by three dimensions: physical fatigue (i.e., feelings of physical tiredness and lack of energy); cognitive weariness (i.e., cognitive wasting and decreased ability to concentrate and think); and emotional exhaustion (i.e., feelings of lack of sensitivity and empathy in relating to others) (Shirom, 2010).

In sum, the main goal of this study is to analyze the relationship between stress, cognitive appraisal, and burnout response. To prove the nature of the interaction between the variables under investigation, we formulated three main objectives: (1) to analyze the direct effect of both stress and cognitive appraisal on burnout; (2) to analyze the mediation effect of cognitive appraisal on the relationship between stress and burnout; and, (3) to analyze the maintenance of cognitive appraisal's mediation effect over time.

We tested three main hypotheses by performing three-step analyses to accomplish the established objectives.

H1 – Direct model. In the first step of data analysis, we tested the direct model, establishing that stress and cognitive appraisal predict burnout responses (see Figure 1). Specifically, we expected higher perceived stress, threat perception, and the use of passive

coping mechanisms (i.e., denial) to be positively related to higher levels of burnout. In parallel, we expected lower perceived stress, challenge perception, and the use of adaptive coping mechanisms (i.e., active coping, humor, and emotional support) to be negatively related to burnout.

H2 – Mediation model (Mt2). In the second step of data analysis, we considered that the adaptation process to stress is better understood when the cognitive appraisal is assumed to mediate the relationship between stress and the consequences of that exposure (i.e., burnout). To do so, we tested the mediation model (see Figure 2, corresponding to Mt1 and Mt2; left side until the dashed line). Specifically, we expected that higher levels of stress to be positively related to threat perception and negatively related to challenge perception; in turn, we expected threat perception to be negatively associated with adaptive coping mechanisms (i.e., active coping, humor, and emotional support) and positively related to passive mechanisms (i.e., denial). In parallel, we expected challenge perception to be positively related to adaptive coping mechanisms (i.e., active coping, humor, and emotional support) and negatively associated with passive mechanisms (i.e., denial). We also expected that using adaptive coping mechanisms (i.e., active coping, humor, and emotional support) was negatively related to increased burnout and that using passive coping mechanisms (i.e., denial) was positively associated with increased burnout. Finally, we expected to maintain the direct relationship between stress, cognitive appraisal, and burnout.

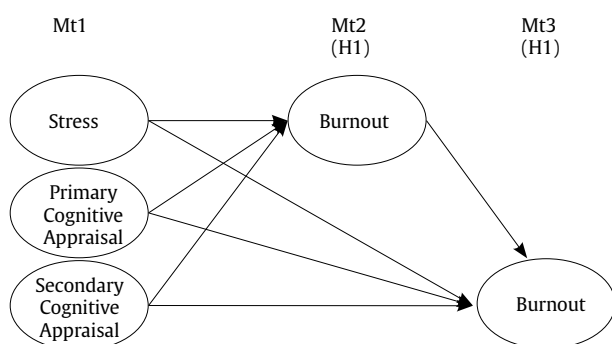


Figure 1. The Direct Model: Relationship between Stress, Cognitive Appraisal, and Burnout.

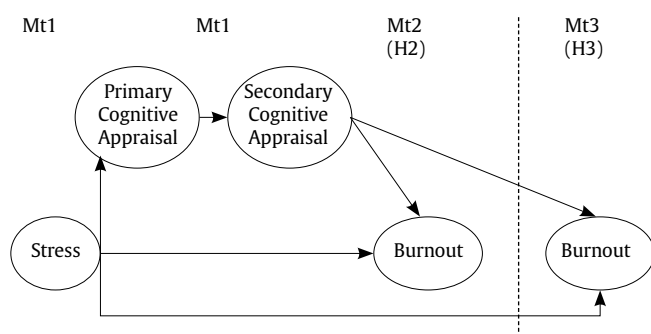


Figure 2. The Mediated Models: Mediation of Cognitive Appraisal at Mt2 and Mt3.

H3 – Mediation model (Mt1, Mt2, and Mt3). In the third step of data analysis, we seek to overcome one of the limitations present

in the literature by analyzing this phenomenon in a longitudinal logic, considering that the mediation of cognitive appraisal occurs and is maintained over time. In this sense, we elaborated new mediation models, adding a second burnout moment (see Figure 2, corresponding to Mt1, Mt2, and Mt3). We expected that the relationships established in H2 would be maintained over time, adding positive relationships from stress, denial, and burnout at the second moment of data collection to burnout at the third moment and negative relationships from adaptive coping mechanisms (i.e., active coping, humor and emotional support) to burnout at the third moment of data collection. Finally, we expected that the mediation model with the two burnout measures would better explain the stress adaptation process.

Methodology

Participants

This study included a sample of 175 Psychology students from a university in Northern Portugal. The sample includes 155 female students (89%), 18 male students (10%), and two students who did not identify gender information (1%). Their age ranged from 17 to 42 years ($M = 21.19$; $SD = 3.947$). In total, 149 (85%) students chose the Psychology course as their first university entry option. Notably, the gender distribution of this study is similar to that reported for the target population.

Instruments

Sociodemographic Questionnaire

This questionnaire comprises a set of items related to personal (e.g., age, gender, marital status) and academic (e.g., course year, course choice, the average number of hours of study per week) variables.

Stress Questionnaire for Students (SQS; Gomes et al., 2022)

The instrument evaluates students' perceptions of seven potential sources of stress that may experience during their academic activity: (1) academic performance: stress related to results below the student's expectations (four items; α in this study = .90); (2) academic evaluation: stress concerning the assessment moments arising throughout the academic year (four items; α in this study = .76); (3) motivation: stress related to the low motivation in performing academic activities (four items; α in this study = .87); (4) learning: stress derived from the difficulty in following the school teaching and learning process (four items; α in this study = .89); (5) work overload: stress concerning the high load of academic activities and tasks (four items; α in this study = .92); (6) future expectations: stress derived from the student not believing that their studies are valuable and exciting (four items; α in this study = .82); and, (7) financial problems: stress derived from the student's inability to continue studying due to economic difficulties (four items; α in this study = .76). This measure includes an item in which the student must evaluate the overall level of academic stress they experience. Items are answered on a 5-point Likert-type scale (0 = *No stress at all*; 4 = *Very high stress*), with higher values indicating higher stress levels in each dimension. The confirmatory factorial analysis (CFA) showed good psychometric properties for this instrument in this study: $\chi^2(327) = 696.82$, $p < .001$; $\chi^2/df = 2.13$; RMSEA = .074, 90% C.I. [0.07; 0.08], $p < .001$; SRMR = .067; CFI = .913; PCFI = .790; TLI = .900.

Primary and Secondary Cognitive Appraisal Scale (PSCA, Gomes & Teixeira, 2016).

The instrument evaluates two dimensions of cognitive appraisal: primary and secondary cognitive appraisal. For this study, we used the dimensions of the primary cognitive appraisal, including three subscales: (1) importance perception: meaning and relevance given to the situation (three items; α in this study = .86); (2) threat perception: judgment of the situation as disturbing and harmful (three items; α in this study = .88); (3) challenge perception: judgment of the situation as stimulating and exciting (three items; α in this study = .61). Items are answered on a 7-point Likert-type scale (0 = *Is not at all important to me*; 6 = *Is very important to me*, for academic activities importance) regarding a specific situation (i.e., exam season), with higher values indicating higher levels of cognitive appraisal in each subscale. Participants fulfilled the instruments by thinking about their academic activity. The confirmatory factorial analysis (CFA) showed good psychometric properties for the instrument in this study: $\chi^2(21) = 48.79$, $p = .001$; $\chi^2/df = 2.32$; RMSEA = .080, 90% C.I. [.05; .11], $p = .048$; SRMR = .081; CFI = .967; PCFI = .564; TLI = .944.

Reduced Coping Inventory (COPING-R; Gomes, 2017)

The instrument evaluates four coping factors: (1) active coping: using direct actions assumed by the person to resolve the problem, which is considered a problem-solving strategy (four items; α in this study = .76); (2) humor: using jokes and anecdotes to deal with the potential negative consequences of the problem, is considered a more active emotion regulation strategy (four items; α in this study = .94); (3) denial: using of thoughts aimed to negate the occurrence of the problem or its potentially negative consequences, being considered a more passive emotion regulation strategy (four items; α in this study = .82); (4) emotional support: using conversations and problem sharing with others to get emotional help, being considered a strategy focused on social support (four items; α in this study = .92). Participants rate the items on a 5-point Likert-type scale (1 = *I never used*; 5 = *I used it many times*), where higher scores mean greater use of each coping strategy. Participants fulfilled the instruments by thinking about how they coped with the academic stress they felt at that moment. The confirmatory factorial analysis (CFA) showed good psychometric properties for the instrument in this study: $\chi^2(97) = 194.79$, $p < .001$; $\chi^2/df = 2.01$; RMSEA = .069, 90% C.I. [.06; .08], $p = .014$; SRMR = .056; CFI = .953; PCFI = .771; TLI = .942.

Shirom-Melamed Burnout Measure (SMBM) (MBSM; Shirom & Melamed, 2006; Adapted by Simões et al., 2021)

The instrument evaluates the levels of burnout resulting from prolonged exposure to stressful situations, and we applied it at two moments of the study, at Mt2 (the first time the burnout measure was collected) and at Mt3 (the second time the burnout measure was collected). Specifically, this instrument evaluated three dimensions: (1) physical fatigue: feelings of physical weariness relative to work (six items; α Mt2 in this study = .93; α Mt3 in this study = .94); (2) cognitive weariness: feelings of cognitive fatigue relative to work (five items; α Mto2 in this study = .95; α Mto3 in this study = .94); and, (3) emotional exhaustion: feelings of emotional overload in the face of interpersonal relationships at work (three items; α Mt2 in this study = .89; α Mt3 in this study = .83). These dimensions comprise a total of 14 items, answered on a 7-point Likert-type scale (1 = *Never*; 7 =

Always). Higher scores indicated higher levels of physical fatigue, cognitive weariness, and emotional exhaustion, thus pointing to higher levels of burnout. In the instrument, we asked students to think about their academic activity for the past 30 days. The confirmatory factorial analysis (CFA) showed good psychometric properties for the instrument in this study, both in Mt2, $\chi^2(74) = 133.16$, $p < .001$; $\chi^2/df = 1.80$; RMSEA = .064, 90% C.I. [.05; .08], $p = .092$; SRMR = .041; CFI = .977; PCFI = .794; TLI = .971; as in Mt3, $\chi^2(70) = 143.04$, $p < .001$; $\chi^2/df = 2.04$; RMSEA = .077, 90% C.I. [.06; .10], $p = .008$; SRMR = .056; CFI = .967; PCFI = .744; TLI = .957.

Procedure

As a first step, we submitted the study protocol to the Ethics Committee (CEICSH 034/2019). It was also approved by the platform of the credit system of the School of Psychology, allowing enrolled students to receive academic credits in exchange for their participation. Upon enrollment, students had access to the objectives and study procedure information. During the collection period, we notified students with the link to the questionnaire, which they had to fill out on an online platform (Qualtrics®) after having accepted the informed consent, highlighting the objectives, optional nature, and anonymity of their participation.

Data collection took place in three moments. First, we collected stress indicators and cognitive appraisal data (four to six weeks after the beginning of the first academic semester, corresponding to Mt1 in the database); then, we collected students' burnout responses in the middle of the academic semester (corresponding to Mt2 in the database); and, finally, we collected the burnout responses again, at the end of the academic semester (corresponding to Mt3 in the database). To link participants' responses in all data collection phases and ensure anonymity, we assigned a code to each participant, known only to them.

Data Analysis Procedure

This study adopted a longitudinal structure design from three different data collection times. We used the IBM® SPSS® (version 27.0) and AMOS (version 27.0) software for the statistical treatment of the data. The first moment of this study had 210 participants, three of whom were removed from the sample because they scored two or fewer points in the "importance" subscale of the PSCA, i.e., participants assessed their activity as not very relevant/or not relevant at all, and, according to Gomes (2014), the adaptation to stress only occurs if the individual evaluates the situation as personally relevant. The second stage obtained 185 participants, and the third obtained 175 participants, the total number of participants in the sample. Next, we performed descriptive and correlational analyses, allowing for the observation of the relationships between the variables under study.

In the next step, AMOS was used to develop six structural equation models, allowing testing of the hypothesized relationships. We performed adjustment analyses considering the following indicators mentioned in the literature (Marôco, 2014): (a) the chi-square test statistic (χ^2); (b) the *Root Mean Square Error of Approximation* (RMSEA, Steiger, 1990), which considers that values between [.05 and .08] indicate a good measure of closeness between the model and the data, and values less than .05 reveal a very good fit of the model; (c) the *Standardized Root Mean Square Residual* (SRMR), which considers a good fit when the values are $< .10$ (Kline, 2005); (d) the *Tucker-Lewis Index* (TLI, Bentler & Bonnet, 1980) and the *Comparative Fit Index* (CFI, Bentler, 1990), which consider a good fit the values between

[.90, .95] and very good when they are $\geq .95$. Finally, we used the Bootstrap procedures to analyze the direct and indirect effects of the model considered the best fit.

Results

Descriptive Statistics of the Variables under Study

Before performing the analyses related to this study, we checked the normality of the distribution of the items, considering the suggested indicators for skewness (values in this study between -2.15 and 1.86) and kurtosis (values in this study between -1.13 and 5.94), concluding for no severe deviations from normality (cf. Kline, 2011). Table 1 presents the descriptive statistics for each study variable. Initially, the overall stress levels experienced by students were analyzed, whereby about 4% of students reported feeling low stress, 30% reported feeling moderate stress, and 66% reported feeling high-stress levels.

Stress, Cognitive Appraisal, and Burnout Relationships

In this step, we tested the relationship between stress factors, cognitive appraisal, and burnout by developing six models distributed over the three hypotheses of the study. Concerning Hypothesis 1, we developed two models to test the direct effect between stress, cognitive appraisal, and coping with burnout. In the first model, we tested the relationship between those variables by considering the burnout measure assessed at the second moment of data collection (Model 1. Direct model - Mt2). Similarly, we tested another direct model that established a relationship between stress, cognitive appraisal, and coping with burnout, assessed at the third moment of data collection by adding the burnout assessment from the second moment (Model 2. Direct Model - Mt3). Both Models 1 and 2 showed a poor fit (see Table 2), not allowing the confirmation of the established direct relationships. In this way, we could not confirm Hypothesis 1 since both tested models showed that the direct relationships predicting burnout responses (in Mt2 and Mt3) were not good explanatory data models. We could not explain the predictor effect of stress and cognitive appraisal on burnout responses in Mt2 with Model 1, nor the effect of stress, cognitive appraisal, and second-moment burnout on burnout responses in Mt3 with Model 2.

Regarding Hypothesis 2, we developed and tested two mediation models. Model 3 considered the mediating role of cognitive appraisal and coping in the relationship between stress and burnout at the second moment of data collection (Model 3. Total mediation model - Mt2). Model 4, in addition to considering the referred mediated relationship, also considered the direct relationship between stress and coping with the burnout measure at the second moment (Model 4. Partial mediation model - Mt2). Comparing both models, the one that revealed a better adjustment was the partial mediation model - Mt2 (Model 4; see Table 2).

Table 2
Mediation Effect: Structural Model Fit Indices (N = 175)

Structural Models	χ^2	df	χ^2/df	RMSEA	RMSEA 90% (LO-HI)	p (RMSEA \leq 0.05)	SRMR	TLI	CFI
1. Direct (Mt2)	175.97	42	4.19	.132	.11; .15	<.001	.121	.631	.871
2. Direct (Mt3)	155.82	42	3.71	.125	.10; .15	<.001	.102	.642	.912
3. Total Mediation (Mt2)	138.58	58	2.39	.087	.07; .11	.001	.126	.839	.922
4. Partial Mediation (Mt2)	73.33	37	1.98	.073	.05; .10	.063	.053	.886	.965
5. Total Mediation (Mt3)	157.98	85	1.86	.070	.05; .09	.029	.118	.887	.944
6. Partial Mediation (Mt3)	72.69	43	1.69	.063	.04; .09	.188	.045	.909	.977

Note. * $p < .05$; ** $p < .01$.

Table 1
Descriptive Statistics of the Variables under Study

Variables	%	
SQS: General Level of Stress		
No stress at all	0	
Not much stress	4.3	
Some stress	30.0	
Very stress	45.9	
Very high stress	19.8	
	M	SD
SQS: Sources of Stress		
Academic performance	2.83	0.83
Academic evaluation	2.99	0.83
Motivation	2.50	0.93
Learning	2.77	0.93
Work overload	3.03	0.86
Future expectations	2.55	0.95
Financial problems	1.62	1.17
PSCA: Cognitive Appraisal		
Importance perception	5.33	0.79
Threat perception	3.68	1.45
Challenge perception	4.09	0.99
COPING-R: Coping Factors		
Active coping	2.28	0.78
Denial	1.10	0.90
Humor	2.20	1.19
Emotional support	2.52	1.09
SMBM: Levels of Burnout (Mt2)		
Physical fatigue	4.56	1.27
Cognitive weariness	4.31	1.37
Emotional exhaustion	1.92	1.16
SMBM: Levels of Burnout (Mt3)		
Physical fatigue	4.40	1.35
Cognitive weariness	4.14	1.35
Emotional exhaustion	1.95	0.99

As for Hypothesis 3, we tested the maintenance of this relationship in the third moment of data collection. Thus, we developed two models. Model 5 (Model 5. Total mediation model - Mt3) considered the mediation of cognitive appraisal and coping in the burnout response at the second moment, adding a direct relationship between burnout at the second and third moments. Model 6 (Model 6. Partial Mediation Model - Mt3) considered the same relationship as the previous model while adding a relationship between stress, coping, and second-moment burnout to third-moment burnout. Comparing the adjustment of the models, the partial mediation model - Mt3 (Model 6) obtained the best adjustment (see Table 2).

Next, comparisons were made between the chi-square values of the models to check for differences between them. Thus, we found statistically significant differences between Model 6 and

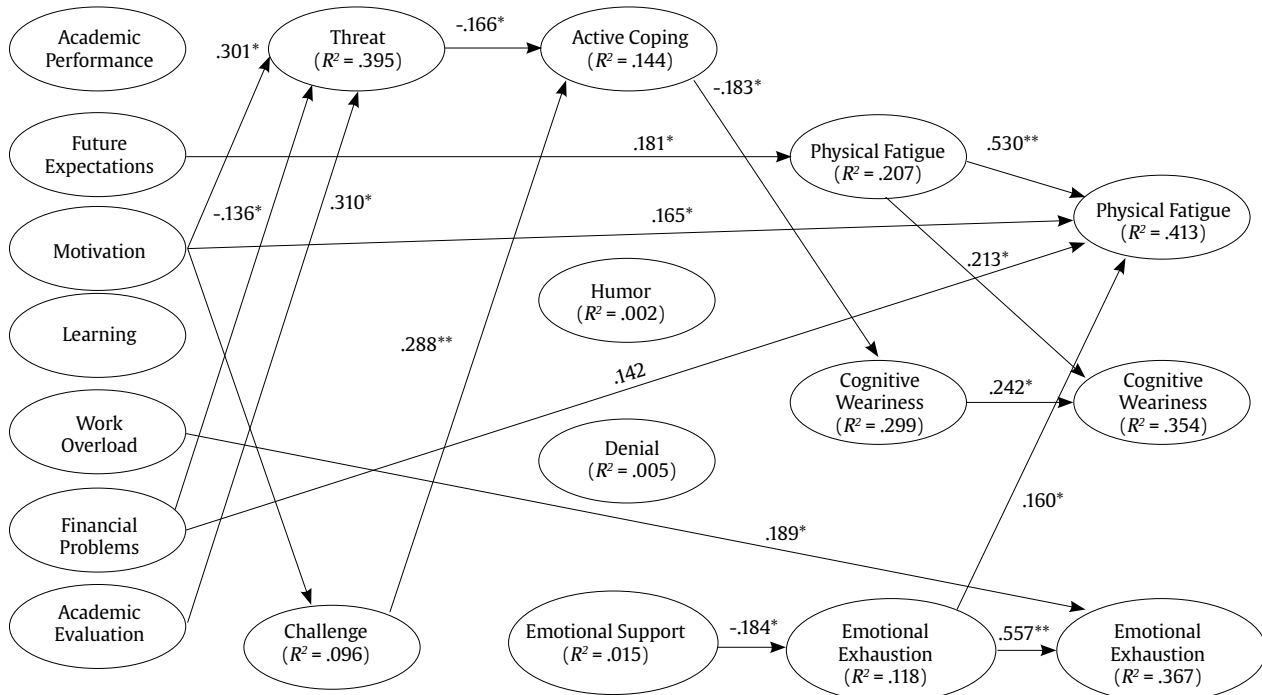


Figure 3. Partial Mediation Model - Mt3 (Hypotheses 2 and 3).

Note. * $p < .05$; ** $p < .01$.

Model 1 ($\Delta\chi^2 = 103.28$; $\Delta df = 1$; $p < .001$), Model 6 and Model 2 ($\Delta\chi^2 = 83.13$; $\Delta df = 1$; $p < .001$), Model 6 and Model 3 ($\Delta\chi^2 = 65.89$; $\Delta df = 15$; $p < .001$) and Model 6 and Model 5 ($\Delta\chi^2 = 85.29$; $\Delta df = 42$; $p < .001$). In contrast, when comparing the chi-square value between Model 6 and Model 4, no significant differences were found ($\Delta\chi^2 = 0.64$; $\Delta df = 6$; $p = .100$).

Nevertheless, this study adopted the partial mediation model - Mt3 (Model 6), presenting the best fit in the indicators. This model explained 40% of the variance associated with threat perception and 10% with challenge perception. It also explained 15% of the variance associated with active coping, 15% with emotional support, and less than 1% with humor and denial. Additionally, the model explained that 21% of the variance was associated with physical fatigue at Mt2 and 41% at Mt3. It also allowed explaining the variance found in cognitive weariness (30% at Mt2 and 35% at Mt3) and emotional exhaustion (12% at Mt2 and 37% at Mt3) (see Figure 3). In sum, the results supported Hypotheses 2 and 3, showing that cognitive appraisal mediates the relationship between stress and burnout responses, explaining better this relationship when maintaining the direct pathways to burnout and that the mediation of cognitive appraisal occurs and maintains over time, explaining better the stress adaptation process when adding a second burnout measure.

Partial Mediation Model - Mt3: Direct and Indirect Effects

In this phase, we analyzed the direct and indirect effects of the partial mediation model - Mt3- to test the mediation of cognitive appraisal and its longitudinal maintenance. The analysis of the significant direct effects (see Figure 3) found that increased stress led to increased burnout. Specifically, increased stress derived from future expectations translated into increased physical fatigue in Mt2, and stress from low motivation and financial problems led to increased physical fatigue in Mt3.

Regarding the mediating role of cognitive appraisal, we observed that three stressors affected burnout via cognitive appraisal. Specifically, increased stress derived from low motivation and academic evaluation exacerbated the threat perception, weakening active coping. Conversely, increased stress derived from financial problems led to a lower threat perception. Also, the increased stress from work overload led to increased emotional exhaustion in Mt3.

In parallel, decreased motivation-related stress led to increased challenge perception, strengthening active coping mechanisms. In addition, the increase in active coping attenuated cognitive weariness at Mt2. There was also a negative path from emotional support to emotional exhaustion in Mt2. Finally, the increase in burnout dimensions at Mt2 led to an increase in these dimensions at Mt3. Furthermore, increased physical fatigue at Mt2 promoted increased cognitive weariness at Mt3, and increased emotional exhaustion at Mt2 promoted increased physical fatigue at Mt3.

Finally, we analyzed the indirect effects, reinforcing the mediating role of cognitive appraisal, as shown in Table 3. The existence of an indirect effect on cognitive weariness in Mt2 derived from cognitive appraisal was verified, highlighting the effect of learning and motivation via the perception of active coping. There was also an indirect effect between challenge and cognitive weariness in Mt2 via secondary cognitive appraisal. Finally, we found an indirect effect between some stress factors (i.e., learning and future expectations) and coping factors (i.e., emotional support and active coping), and burnout measures corresponding to the third moment, which may be mediated by the cognitive appraisal or by the burnout of the second moment.

Discussion

Research has highlighted the stressful nature associated with university students (Amhare et al., 2021; Bergmann et al., 2019) and the need to understand the process of adaptation to stress to avoid

Table 3
Standardized Indirect Effects of the Partial Mediation Model - Mt3 (Hypotheses 2 and 3)

variables		Coping-R	Burnout Mt2 (SMBM)	Burnout Mt3 (SMBM)		
		Active Coping	Cognitive Weariness	Emotional Exhaustion	Cognitive Weariness	Physical Fatigue
Sources of Stress (SQS)	Work Overload	--	-0.011* [-0.040; -0.002]	--	--	--
	Learning	-0.077* [-0.140; -0.014]	0.014* [0.004; 0.033]	--	0.087* [0.013; 0.184]	--
	Motivation	-0.116** [-0.199; -0.047]	0.021* [0.005; 0.055]	--	--	--
	Future Expectations	--	--	--	0.075* [0.019; 0.165]	0.099* [0.041; 0.236]
Cognitive Appraisal (PSCA)	Challenge	--	-0.053* [-0.116; -0.014]	--	--	--
Coping - R	Emotional Support	--	--	-0.096** [-0.182; -0.031]	--	--
	Active Coping	--	--	--	-0.073* [-0.165; -0.016]	--

Note. * $p < .05$; ** $p < .01$.

severe problems such as burnout (Eaves & Payne, 2019; Muzafar et al., 2015). So, this study sought to understand the process of adaptation to stress in psychology university students, considering the interactive and transactional approach (Gomes, 2014; Lazarus, 1991). Specifically, this study analyzed the direct effect of stress and cognitive appraisal on burnout in the first objective. The second objective considered the mediation effect of cognitive appraisal on the relationship between stress and burnout. To address the limitations of cross-sectional studies in this area (Enns et al., 2018; Shah et al., 2010), in the third objective, we analyzed the maintenance of cognitive appraisal's mediation effect over time, considering three data collection moments. In addition to these goals, we sought to identify the students' experience of stress and burnout levels in their academic activity.

Similar to previous studies, we found that a significant proportion of students (66%) reported high stress levels (Jordan et al., 2020; Poots & Cassidy, 2020). As for the potential stressors contributing to this experience, work overload and academic evaluation stand out. These results are in line with other studies that consider academic stressors as the most reported by students (Al-Gamal et al., 2018; Shah et al., 2010), in particular, the evaluation periods and work overload (Arusha & Biswas, 2020; Pitt et al., 2018). Concerning how students assessed their academic activity, we found they had high importance and challenge perceptions regarding academic activity and used more emotional support and active coping strategies to cope with demands. The literature has not been consistent in identifying the cognitive appraisal profile most exhibited by students (Gibbons, 2010); however, some studies indicate they used more problem-solving strategies (Al-Gamal et al., 2018; Joseph et al., 2020), while other studies concluded that social support strategies were the most reported (Pierceall & Keim, 2007). Our study complements these indications by giving prominence to both coping strategies and adding the need to consider mood strategies in how students cope with stress. As for burnout levels, physical fatigue was the most prevalent at both time points, followed by cognitive weariness. Other studies have obtained a similar pattern (Baganha et al., 2016; Casuso-Holgado et al., 2019), reinforcing that the main effect of stress is at the level of physical symptoms.

Regarding Hypothesis 1, we analyzed the direct relationship between stress, cognitive appraisal, and burnout, which was not confirmed. Hypothesis 2 confirmed the mediation effect of cognitive

appraisal on the relationship between stress (the antecedent variable) and burnout (the consequent variable). In testing this hypothesis, we considered two models: the total mediation model - Mt2 (Model 3), which assumed relationships between stress and burnout mediated by the cognitive appraisal, and the partial mediation model - Mt2 (Model 4), which considered the mediated relationship of cognitive appraisal and added direct pathways to burnout. The results indicated that the partial mediation model (Model 4) obtained a better fit, as suggested in other studies (Gomes et al., 2013; Reis et al., 2018). However, although Hypothesis 2 was accepted, the data indicated that the model fit improved by adding the last burnout moment. Thus, this study adopted the partial mediation model - Mt3 (M6) as suggested in Hypothesis 3. These results indicate that stress does have an increased effect on burnout, but we can better explain this relationship when we add cognitive appraisal as a mediation variable and when considered longitudinally. Thus, these findings confirmed Hypothesis 3.

Analyzing the data from the partial mediation model - Mt3, we found that the increase in some sources of stress (i.e., future expectations, motivation, work overload, and financial problems) had direct repercussions on burnout, increasing the symptomatology (i.e., physical fatigue Mt2 and Mt3, and emotional exhaustion Mt3). The literature supports this detrimental effect of stress on burnout (Lin & Huang, 2014; Marôco et al., 2020). In particular, the study of Muzafar et al. (2015) reported work overload, fear of failure, uncertainty about the future, and financial problems as stress factors that can predict burnout symptoms. However, the analysis of the adopted model reinforces mainly the mediating role of cognitive appraisal between the stimulus (i.e., stress) and its repercussions (i.e., burnout). Thus, we considered two mediation patterns presented by students.

On the one hand, the stress derived from low motivation and academic evaluation exacerbated threat perception, weakening the active coping mechanisms. This decrease in active coping promoted increased cognitive weariness in Mt2 and the maintenance of this effect in the cognitive weariness in Mt3. In parallel, decreased stress from low motivation promoted higher challenge perception, strengthening active coping mechanisms. These, in turn, decrease the perception of cognitive weariness at Mt2 and the maintenance of this effect in Mt3. These patterns align with the relationships proposed in Hypothesis 3 and are consistent with the theoretical

approaches to stress adaptation (Gomes, 2014; Lazarus, 1991). However, we should note that not all established relationships were significant. Firstly, we observed that the increase in stress derived from low motivation and academic evaluation led to an increase in threat perception, and conversely, the decrease in stress derived from motivation led to an increase in challenge perception. Results from other studies found the same paths (Devonport & Lane, 2006; Lepine et al., 2004), confirmed by the Lazarus model (1991), which argues that the perception of higher levels of stress as disruptive and harmful and lower levels of stress as stimulating and exciting. However, it is essential to note that there is an unexpected path through increased stress due to financial problems and decreased threat perception (Lazarus, 1991; 1999).

Regarding the mediating effect of cognitive appraisal, we should note that stress perceived as a threat led to a decrease in active coping strategies, and conversely, stress perceived as a challenge led to an increase in active coping strategies. The literature justifies this relationship by considering that when students perceive stress sources as threatening to their performance, they mobilize fewer effective coping strategies. In contrast, when students perceive stress as challenging, they can cope with it and mobilize the necessary resources to manage it (Carver & Scheier, 1994; Deasy et al., 2014). Furthermore, according to Hypothesis 3, the use of adaptive coping mechanisms (i.e., active coping, humor, and emotional support) would be able to mitigate the effects of burnout, and, on the contrary, the use of passive coping mechanisms (i.e., denial) would potentiate more significant symptomatology of burnout. The model analysis partially corroborated this result since students show a lower propensity for cognitive fatigue when using active coping strategies. The same was true for emotional support strategies that attenuated emotional exhaustion. Several studies have proven the effect of adaptive coping mechanisms in reducing the consequences of stress (Bulanda et al., 2020; Joseph et al., 2020) and, consequently, in preventing burnout (Gibbons, 2010; Vizoso et al., 2019). However, for this study, strategies focused on emotion regulation (i.e., humor and denial) did not obtain a significant variance. These findings may be associated with students using more problem-solving-focused strategies than emotion regulation-focused ones (Al-Gamal et al., 2018; Dyson & Renk, 2006). Finally, contrary to expected, no direct relationships existed between coping and burnout in Mt3.

Regarding the last objective, namely the longitudinal profile of this relationship, we found a relationship between the two moments of burnout; that is, the increase in burnout at Mt2 impacted the increase in burnout at Mt3, thus confirming the chronic nature of this syndrome (Maslach & Leiter, 2016; WHO, 2019). Thus, these results clarify the harmful and lasting effect of stress in increasing burnout, highlighting the equally relevant role of how students evaluate their activity and the resources they have to cope with it. Future research should consider the different academic years separately, as some studies show that students' stress and burnout levels differ depending on the year of the course they are in (Amhare et al., 2021; Duffy et al., 2020).

This study has some limitations, mainly in the generalization of results, given the small sample size and the fact that it was restricted to the psychology course, not representing the remaining university students. In addition, since the study occurred during the COVID-19 pandemic, some factors may not have been controlled. In sum, this study reinforces the complexity of studying stress adaptation from a longitudinal perspective, considering the mediating role of cognitive appraisal. When planning curricula and evaluations, universities should consider students' stress, burnout, and cognitive appraisal patterns. They should also provide students with adequate resources for effectively managing stressful situations imposed throughout the course.

Founding

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Conflict of interest

The manuscript has never been published before and constitutes an original article. The author(s) declare that they have no competing interests.

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