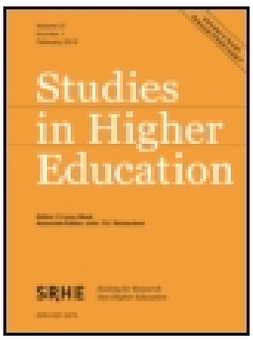

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Applying stress theory to higher education: lessons from a study of first-year students

James H. Amirkhan, Graham K. Bowers and Christina Logan

Department of Psychology, California State University Long Beach, Long Beach, CA, USA

ABSTRACT

Studies of stress and coping effects on college performance have yielded inconsistent results, which might be clarified by stricter adherence to stress theories. Here, university students ($n = 1212$) were surveyed during their first year, said to be the most stressful. They completed measures of stress overload (the pathogenic state identified by theory) and coping preferences (the strategies most reported in the literature), and granted access to their official grade and enrollment records. Regression analyses showed stress overload to relate to poorer performance, and avoidance coping to relate to greater stress overload. SEM models indicated a theory-consistent causal sequence fit the data better than the reverse. However, after model modifications, only avoidance showed an effect on performance mediated by stress overload, as predicted, while other strategies showed direct effects. Study limitations in regard to causal inferences and generalizability, and larger problems in applying medical stress theories to academia, are discussed.

KEYWORDS

Stress; coping; stress overload; grades; attrition; university students

The first year of college, with all of its requisite transitions, is said to be one of the most stressful periods in life (Dyson and Renk 2006; Hicks and Heastie 2008). Some researchers have examined whether this stress impedes student success and retention (DeBerard, Spielmans, and Julka 2004; Shields 2001; Struthers, Perry, and Menec 2000), but the findings have been inconsistent, with no clear consensus as to the impact of stress or the efficacy of coping methods. The purpose of the present investigation was to revisit classical theories of stress, which were proffered to explain health problems, and apply their tenets to academic problems. This approach did, in fact, reveal complex connections among stress, coping, and the performance of first-year students. However, the fit of medical theory to academia was not perfect, and the problems encountered were noted as cautionary tales for future investigations.

Stress, coping, and student performance

Although there is a vast literature on college student stress, only a minority of studies have investigated its effects on academic performance. The majority examine the impact of stress on student well-being, ignoring academic outcomes (e.g. Ben-Zur and Zeidner 2012; Chao 2012; Pritchard, Wilson, and Yamnitz 2007). Numerous other studies attempt to inventory college stressors (see Hurst, Baranik, and Daniel 2013), ignoring outcomes altogether (e.g. Ji and Zhang 2011; Ross, Niebling, and Heckert 1999). In the words of researchers in this field, ' … to our knowledge, little attention has been paid thus far to the effects that the experiencing of long-term stress symptoms may have on academic achievement' (Schraml et al. 2012, 71).

CONTACT James H. Amirkhan james.amirkhan@csulb.edu

In studies that do examine the academic impact of stress, the role of coping is typically considered. Coping has been defined as the cognitive and behavioral efforts made to manage stressful experiences, and was initially categorized as having either problem-focused or emotion-focused functions (Folkman and Lazarus 1985). Since then,

> the literature has converged on the following three categories: (a) *Problem-focused* coping, designed to manage or solve the problem by removing or circumventing the stressor (e.g. carefully planning …); (b) *Emotion-focused* coping, designed to regulate, reduce, channel, or eliminate the aversive emotions associated with the stressful encounter (e.g. seeking emotional support …); and (c) *Avoidance-focused* coping, referring to strategies designed to circumvent or avoid the stressful situation (e.g. distracting oneself …) (Ben-Zur and Zeidner 2012, 714).

There is considerable evidence that people have stable preferences among these coping strategies (Watson and Hubbard 1996), such that a person's response to one stressor can predict their response to another (e.g. Amirkhan 1994).

The choice among coping strategies has important consequences for the impact of a stressor, sometimes ameliorating and sometimes exacerbating stress levels (Lazarus 1990). But in academia, 'it is still not clear which coping mechanisms provide the most successful adaptation to university life' (Sasaki and Yamasaki 2007, 52). For example, a meta-analysis of 237 studies of college students (Credé and Nichorster 2012) showed the use of emotion-focused strategies to be detrimental to 'academic adjustment', an index related to grades and retention. But in a large sample of undergraduates ($n > 3000$), emotion-focused strategies were found to have no relationship to grades (Britt-Lutter et al. 2017). Yet another investigation (Abdullah et al. 2010) reported emotion-focused strategies to have generally positive associations with grades.

It is surprising that studies of student stress and coping could yield such divergent findings, given that they essentially sampled from the same population. Methodological variations could explain this. First, many of the studies did not assess stress, assuming it to be a given for college students (e.g. DeBerard, Spielmans, and Julka 2004; Dyson and Renk 2006; Largo-Wight, Peterson, and Chen 2005). It was therefore undetermined which coping strategies were most effective in reducing stress, or even if stress reduction was the mechanism by which coping affected academic performance. Second, in the studies that did assess stress (e.g. Ji and Zhang 2011; Maddi et al. 2009), none of the measures completely captured stress overload, the form of stress said to produce dysfunction (Amirkhan 2012). This meant there were variations in the predictive validity of the instruments, which could also explain the inconsistent findings. Third, there were differences in the presumed temporal sequence, with some studies seeing stress as a precursor (e.g. Struthers, Perry, and Menec 2000) and others seeing it as an outcome of coping efforts (e.g. Mahmoud et al. 2012). Because temporal assumptions dictate statistical analyses, the divergent timelines could also be a reason for divergent results. The premise here was that a return to stress theories would provide direction as to which measures and what chronology should be used, ultimately yielding a more accurate picture of the impact of stress and coping on first-year grades and attrition.

Stress theories

Seminal stress theories evolved in the context of health, attempting to explain why not everyone exposed to stressors gets sick. In the earliest model, Selye (1956) proposed that stressors disrupt homeostasis and prompt feelings of distress. However, in most cases the body copes by rallying physiological reserves, so that homeostasis is regained and stressful feelings dissipate. It is only when the stressors exhaust resources that the body becomes susceptible to disease. A later, but equally influential, model characterized stress as a psychological rather than a biological phenomenon (Lazarus and Folkman 1984). Following stressor recognition (primary appraisal), a person weighs its demands against coping resources (secondary appraisal). If resources are deemed adequate, the stressor is perceived as a 'challenge', perhaps stressful but manageable. If resources are seen to be inadequate, however, the stressor assumes the proportions of a 'threat', triggering mental and

somatic disturbances. Subsequent theories, both biological (e.g. McEwen 2000) and psychological (e.g. Hobfoll 1989), repeated this theme: 'They all share … a process in which environmental demands tax or exceed the adaptive capacity of an organism, resulting in psychological and biological changes that may place persons at risk for disease' (Cohen, Kessler, and Gordon 1995, 3).

Pathogenic stress is therefore the product of two intersecting processes: (1) an abundance of demands coinciding with (2) a scarcity of resources. Labeled 'stress overload' (Amirkhan 2012) to differentiate it from more fleeting and benign feelings of distress, there is considerable evidence showing it linked to health problems (Amirkhan 2012, 2016; Amirkhan, Landa, and Huff 2017; Amirkhan, Urizar, and Clark 2015). There is even some evidence to show it linked to academic problems. Applying Lazarus' theory to college performance, it was found that students appraising an exam as a threat were more likely to report negative emotions, emotion-focused coping, and poor scores (Folkman and Lazarus 1985). This was an early indication that stress overload was linked to poor performance, but the study relied on self-reported outcomes to a single stressor. A broader application of that theory affirmed that college students who generally appraised academic stressors as threats used less adaptive coping strategies and experienced more negative emotions (Ben-Zur and Zeidner 2012). But this was a cross-sectional study that did not assess academic outcomes. A recent study found mid-term stress overload predicted official records of GPA and enrollment at term-end (Amirkhan and Kofman 2018). But this study failed to assess coping. Extant evidence that stress overload and coping impact academic performance is therefore somewhat compromised.

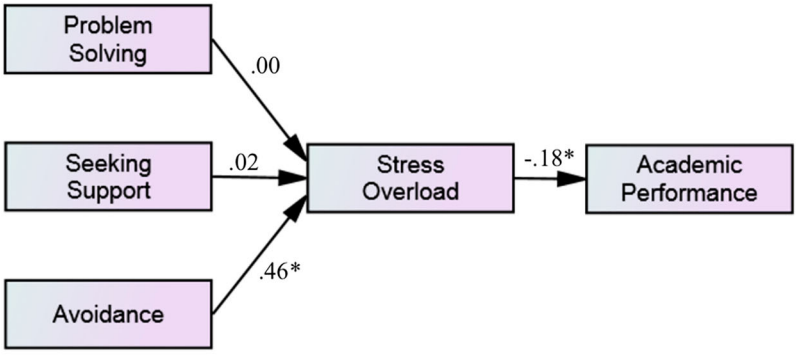
Implications of stress theories for methodology

If education researchers are to assess stress overload, they must abandon the idea that stress is a single construct, and adjust their measurement methods. To date, most studies of students have focused solely on the demand component of stress overload, assessing stress by means of stressor checklists (see Hurst, Baranik, and Daniel 2013). But, according to theory, tabulating demands without considering resistive resources could overestimate the stress levels of many students. Another approach has been to focus on resources, using student resilience (Steinhardt and Dolbier 2008), social support (Chao 2012), study skills and self-efficacy (Robbins et al. 2004) to predict academic outcomes. This method also runs counter to theory; inventorying resources without considering the drain of demands could underestimate stress levels. To be consistent with stress theories, and accurately gauge overload, both student demands and resources must be considered.

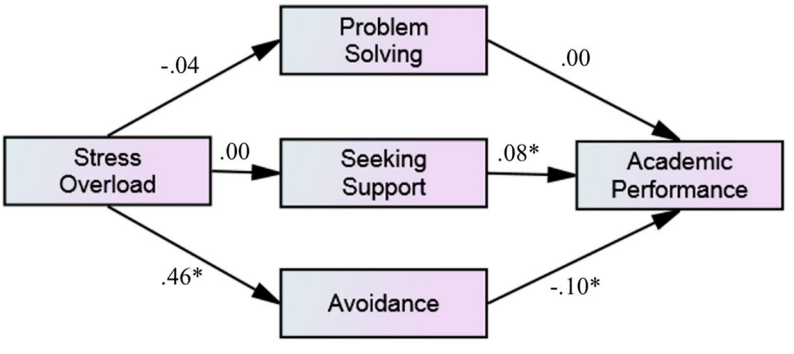
The stress overload perspective also suggests a temporal sequence in which stress is an aftereffect of coping. Theories agree that *stressors* initiate the sequence, but show *stress* to be the end product of actual (per Selye) or perceived (per Lazarus) coping failures (as in Figure 1, Model 1). In contrast, many researchers (e.g. Shields 2001; Struthers, Perry, and Menec 2000) assume stress to be the antecedent that spurs coping and determines outcomes through that mediator (as in Figure 1, Model 2). Adopting the theory-implied sequence affects study methods. It dictates that stress overload be measured, because as a product of idiosyncratic coping efforts, levels cannot be assumed equivalent for all students. It also directs data analysis, indicating that coping (a more distal predictor) cannot be expected to correlate directly with academic outcomes, and that stress overload (the more proximal predictor) must be tested as a mediator of such correlations.

Current study

The present study examined first-year university students, because they provide rich opportunity for exploring the effects of stress and coping. It focused on academic performance specifically, utilizing health-based stress theories to derive a clearer model of its determinants than has been afforded by past research. This approach informed both the study hypotheses and methods. In regard to the former, it was hypothesized that (1) stress overload, being more proximal, would be more predictive of academic outcomes than coping strategies; (2) different coping strategies would relate



Model 1. Stress overload is the outcome of failed coping and directly impacts academic performance.



Model 2. Coping mediates the effect of stress overload on academic performance.

Figure 1. Hypothetical models linking stress and coping to student performance, showing theory-implied (Model 1) and alternate (Model 2) sequences used in prior research.

(Numerical values are standardized regression coefficients obtained in present study, *$p < .01$).

differentially to stress overload, either mitigating or exacerbating its severity; and (3) stress overload would mediate the relationship of coping strategies to academic outcomes.

Testing the fit of theory to academic performance required methodological departures from preceding studies: First, student stress levels were measured rather than assumed. Second, a measure specific to the destructive state of stress overload was employed, capturing the conjoint effect of high demands and low resources. Third, a semi-longitudinal rather than cross-sectional design was utilized, in which stress and coping scores taken mid-term were used to predict year-end performance. Additional methodological adjustments included the use of a coping measure that captured the three major strategies in the literature (Ben-Zur and Zeidner 2012), university records as indices of academic performance, and contemporaneous assessment of stress overload and coping to allow testing of alternative sequences.

Method

The study was conducted within a cohort of first-year students at a large, public university. To ensure representativeness and adequate numbers for statistical modeling, two independent samples were

drawn, one during the first and one during the second semester. In both, students were surveyed mid-term, and asked for access to official records of their subsequent GPA and enrollment. All procedures were approved by the University's IRB.

Participants

Participants were adult first-year students, recruited from mandatory general education courses. Of 1300 surveys distributed, 1212 (93%) were returned sufficiently complete to permit analysis (i.e. no missing responses on the primary measures). Of these, 634 (52%) were collected during the first, and 578 (48%) during the second semester.

Measures

Stress overload

The Stress Overload Scale-Short (SOS-S; Amirkhan 2016), a brief measure constructed specifically to assess stress overload, was used. Like its parent measure (Amirkhan 2012), the SOS-S consists of items describing thoughts and feelings of being overwhelmed, which comprise two factor-analytically derived scales. Five Event Load items assess perceived demands (e.g. 'felt like things kept piling up'), and five Personal Vulnerability items assess perceived insufficiency of resources (e.g. 'felt inadequate'). Respondents indicate the degree to which they experienced each in the prior week, by means of 5-point Likert scales anchored at 1 (*not at all*) and 5 (*a lot*). Scale scores are typically summed, with totals ranging from 10 to 50. Higher totals indicate more demands coupled with fewer resources and hence a greater likelihood of stress overload. Despite its brevity, the SOS-S is reliable, both in terms of internal consistency ($\alpha = .94$) and test-retest stability ($r = .75$ over one week). It has demonstrated construct validity in terms of strong convergence with its parent measure ($r = .81$), and criterion validity in terms of predicting symptoms and illness behaviors (Amirkhan 2016).

Coping strategies

The Coping Strategy Indicator (CSI; Amirkhan 1990) was used to assess preferences among the fundamental coping strategies. It is comprised of three factor-analytically derived scales of 11 items each: Problem Solving (e.g. 'formed a plan of action in your mind'), Seeking Social Support (e.g. 'let your feelings out to a friend'), and Avoidance (e.g. 'watched television more than usual'). Respondents recall a recent problem in their lives, and respond to each item using a 3-point scale labeled 1 (*not at all*), 2 (*a little*), and 3 (*a lot*). The CSI does not yield a single total but rather three scale scores, one for each strategy, ranging from 11 to 33. The scales have demonstrated internal consistency, with alphas from .84 to .93, and test-retest reliability, with correlations averaging .82 across 4- to 8-week spans (Amirkhan 1990). They have shown convergence with measures of coping, personality, and pathology, and independence from social desirability bias. Criterion validity was evidenced in the CSI's ability to predict actual coping choices made in both laboratory simulations and real-world settings (Amirkhan 1994).

Academic performance

Grade-point averages for the full first year were obtained from official university records (Cumulative GPA). GPA values range from 0.0 to 4.0, and are the most commonly used means of quantifying academic performance (York, Gibson, and Rankin 2015). Enrollment status at the beginning of the sophomore year was also obtained, and coded into an Attrition variable, 1 (*re-enrolled*) or 2 (*not enrolled*).

Demographics

The background information most often used by universities to predict academic performance (Reason 2009) was obtained with a brief questionnaire. This included basic demographics (age,

gender, ethnicity), academic information (unit load, average hours per week at work and on campus), and family background (highest level of education achieved by either parent, household income bracket).

Procedures

Sampling

Participants had to be over 18 years old, and enrolled full-time at the Freshman level. Recruitment took place in courses required of all first-year students, regardless of major. Instructors were asked for 15 min of class time to conduct the study. In the Fall semester, 29 of 40 instructors agreed, for a total of 58 classes. In the Spring, 31 of 69 instructors consented, for a total of 70 classes. Each class had approximately 20 students.

Data collection

Mid-semester was chosen as the best time for the survey, because college demands and deprivations had set in but course grades had not yet been determined. Class visits were arranged for a date near midterms. In each class, research assistants described the study, recruited participants, and conducted consent procedures. The Informed Consent requested access to official transcripts, and indicated that responses would be confidential but not fully anonymous. Consenting students received survey packets containing the SOS-S and CSI in counterbalanced orders, always followed by Demographics (to avoid priming effects). When finished, students deposited their packets into a locked box and received a small incentive (candy). Student ID numbers, obtained on consent forms, were provided to the Institutional Research office to obtain the participants' GPA at the end of the first year, and enrollment status at the beginning of the second year.

Results

Sample characteristics

Participant demographics are shown in Table 1. The samples from both semesters closely approximated the 'Freshman Census', and, being drawn from a minority-serving institution, they exhibited diversity. Genders were well represented, although there were more women than men. Multiple ethnicities participated, although the numbers of African-Americans (< 5%), Pacific Islanders (< 2%), and Native Americans (< 1%) were small. A spectrum of socio-economic levels was present, as evidenced by the range of parent income and education levels. Only age showed restricted variability, due to the fact that all participants were first-year students.

The two samples resembled one another. In terms of demographics, they differed in age alone, $\chi^2(3) = 123.87$, $p < .0001$, with the second-semester sample predictably older. In regard to study variables, there were no significant differences in SOS-S scores, CSI scores, GPA, or Attrition rates. Owing to their similarity, the samples were combined for analyses.

Scale characteristics

Scale metrics obtained in this student population are shown in Table 2. The SOS-S demonstrated good internal consistency, with alpha levels approximating those found in the general population (Amirkhan 2016). The Event Load and Personal Vulnerability subscales, derived from oblique factors, correlated as expected, $r = .68$, $p < .0001$, *95% CI* [.65, .71]. Total scores exhibited good variability of response, covering the entire range of possible values, with means close to mid-range, and large standard deviations. There was no evidence of ceiling or basement effects that might compromise analyses.

Table 1. Demographic composition of study samples.

Description	Sample 1 Freshmen 1st semester	Sample 2 Freshmen 2nd semester	University census Incoming freshmen
Size (*n*)	634	578	4291
Gender			
Male	257 (41%)	247 (42%)	40.9%
Female	377 (59%)	331 (56%)	58.9%
Age			
18 yrs.	541 (85%)	335 (56%)	80.7%
19 yrs.	73 (12%)	218 (37%)	16.8%
20 yrs.	13 (2%)	3 (0.5%)	0.5%
> 20 yrs.	9 (1%)	5 (0.8%)	0.1%
Ethnicity			
African-American	20 (3%)	23 (4%)	3.8%
Asian-American	191 (30%)	179 (30%)	23.4%
Latino	229 (36%)	216 (36%)	39.0%
Caucasian	126 (20%)	89 (15%)	18.7%
Other / mixed	60 (10%)	77 (13%)	8.6%
Parents' education			
High school or less	250 (40%)	253 (43%)	40.8%
Some college	135 (21%)	118 (20%)	21.8%
College degree	165 (26%)	153 (26%)	23.9%
Advanced degree	74 (12%)	64 (11%)	13.5%
Parents' income			
< $25000	152 (24%)	159 (27%)	23.7%
25000–49999	141 (22%)	140 (24%)	22.6%
$50000–$99999	168 (27%)	153 (26%)	29.6%
> $100000	124 (20%)	99 (17%)	24.1%

Note: 'Asian-American' includes Pacific Islanders; 'other' includes Native Americans.

The CSI Problem Solving (PS), Seeking Support (SS) and Avoidance (AV) scales showed good internal consistency, similar to levels found in normative samples (Amirkhan 1990). Unlike norms, however, the scales were not orthogonal: PS and SS correlated here, $r = .26$, $p < .01$, *95% CI* [.21, .31]. The ranges, means, and standard deviations indicated good variability of response on all three scales, with no evidence of ceiling or basement effects.

Table 2. Descriptive statistics and zero-order correlations for combined samples.

	Descriptives				SOS-S	CSI			Outcomes	
Variable	*M*	SD	*R*	*α*	Total	PS	SS	AV	C. GPA	Attrition
Demographics										
Age	18.33	0.67	18–25		−.02	.05	.05	.02	−.03	.09*
Gender					.18*	−.03	.19**	.12*	.13*	−.06*
Background										
Parents' education					−.09*	−.04	.06	−.05	.09*	.02
Parents' income					−.14*	−.02	.05	−.07	.05	.01
Units enrolled	13.88	1.87	3–24		−.01	.01	−.01	−.00	.10*	−.10*
Hours at work	6.82	10.18	0–52		.16*	.06	−.01	.06	−.16*	.11*
Stress overload										
SOS-S total	32.14	9.40	10–50	.91		−.04	−.00	.46**	−.17*	.09*
Coping (CSI)										
Problem solving	24.57	5.09	11–33	.87			.26*	−.08	.03	.07
Seeking support	22.37	6.09	11–33	.92				−.05	.09*	−.03
Avoidance	21.65	4.59	11–33	.77					−.10*	.07
Academic outcomes										
Fall GPA	2.93	0.77	0–4		−.20**	.04	.10*	−.12*	.84**	−.32**
Spring GPA	2.86	0.84	0–4		−.17**	.03	.07	−.11*	.87**	−.42**
Cumulative GPA	2.89	0.75	0–4		−.17**	.03	.09*	−.10*		−.49**
Attrition	1.10	0.30	1–2		.09*	.07	−.03	.07		

*$p \leq .01$; **$p \leq .0001$.
Note: Higher gender indicates female; higher attrition indicates drop-out.

The Attrition index was limited in range, with only 119 (10%) of the sample failing to re-enroll. Cumulative GPA showed good variability, with means in the 'C' range and large standard deviations. Thus, there was a possibility that correlations with Attrition, although not GPA, were attenuated.

Tests of Hypothesis 1

Consistent with predictions, zero-order correlations (Table 2) showed SOS-S scores to relate to both Cumulative GPA and Attrition, while only two of the three CSI scales (SS and AV) related to only GPA. However, these correlations also showed Gender to be associated with both the predictors and the academic outcomes, indicating that it was a potential third-variable confound. To address this possibility, hierarchical regression analyses were used. With Cumulative GPA as the DV, Gender was entered as the first IV; subsequent steps entered SOS-S and CSI scores in alternate orders. As shown in Table 3, when CSI scores (PS, SS, AV) were added in a block to the equation, they significantly augmented the variance explained by Gender alone ($\Delta R^2 = .03$, $p < .0001$). Adding SOS-S scores further improved the equation ($\Delta R^2 = .06$, $p < .0001$). These results indicated that the SOS-S had predictive value over and above the CSI. Reversing the order of entry, SOS-S scores significantly increased the variance explained by Gender alone ($\Delta R^2 = .05$, $p < .0001$), but stepping in CSI scale scores did not further improve the equation. This indicated that the SOS-S, not the CSI, was the stronger predictor of GPA.

Attrition served as the DV for the second set of hierarchical regression analyses; because it was a dichotomous variable, binary logistical regression was used. As before, Gender was always entered in the first step. As shown in Table 4, when CSI scores were added at the second step, they significantly improved the predictive power of the equation $\Delta\chi^2$ (3) = 16.17, $p = .001$. Adding SOS-S scores at the final step further improved the equation, $\Delta\chi^2$ (1) = 7.65, $p = .003$. This time, reversing the order of entry did not change the results. Adding SOS-S scores at the second step significantly increased the variance explained by Gender alone, $\Delta\chi^2$ (1) = 13.65, $p < .0001$. And adding CSI scales at the final step further improved the equation, $\Delta\chi^2$ (3) = 10.17, $p = .017$. Closer inspection of the latter effect showed it was entirely due to the contribution of PS scores, $\beta = 0.61$, $p = .005$, *95% CI* [.56, .66]; neither SS ($\beta = -0.25$, $p = .136$) nor AV ($\beta = 0.31$, $p = .199$) contributed significantly to the prediction of Attrition.

In sum, these results partially support Hypothesis 1. They do indicate that stress overload had a greater impact on grades than coping strategies, suggesting it to be the more proximal influence.

Table 3. Summary of hierarchical regression analysis for predictors of cumulative GPA.

	Model 2			Model 3		
Predictor	*β*	*t*	*p*	*β*	*t*	*p*
Gender	.14	4.66	.000**	.16	5.43	.000**
Problem solving	.01	0.45	.651	.02	0.56	.573
Seeking support	.05	1.75	.080	.05	1.74	.083
Avoidance	−.11	−3.89	.000**	−.03	−1.05	.292
Stress overload				−.18	−5.56	.000**
R^2	.032			.056		
F for change in R^2	6.93**			30.90**		
		Model 2 (R)			Model 3 (R)	
Gender	.17	5.85	.000**	.16	5.43	.000**
Stress overload	−.20	6.82	.000**	−.18	−5.56	.000**
Problem solving				.02	0.56	.573
Seeking support				.05	1.74	.083
Avoidance				−.03	−1.05	.292
R^2	.054			.056		
F for change in R^2	46.45**			1.89		

*$p \leq .01$; **$p \leq .0001$.

Note: Model 1, with gender as the sole predictor, is not shown. Higher gender indicates female. (R) indicates that the order of entry for SOS-S and CSI predictors was reversed.

Table 4. Summary of hierarchical logistical regression analysis for predictors of attrition.

	Model 2			Model 3		
Predictor	*B*	Wald	*p*	*B*	Wald	*p*
Gender	.38	3.51	.061	.45	4.88	.027
Problem solving	.06	8.28	.004*	.06	8.05	.005*
Seeking support	−.03	2.23	.136	−.03	2.22	.136
Avoidance	.06	7.80	.005*	.03	1.65	.199
Stress overload				.03	7.37	.007*
χ^2	19.97**			27.61**		
Change in χ^2	16.17*			7.65*		
		Model 2 (R)			Model 3 (R)	
Gender	.51	6.58	.010*	.45	4.88	.027
Stress overload	.04	13.02	.000**	.03	7.37	.007*
Problem solving				.06	8.05	.005*
Seeking support				−.03	2.22	.136
Avoidance				.03	1.65	.199
χ^2	17.44**			27.61**		
Change in χ^2	13.65**			10.17*		

*$p \leq .01$; **$p \leq .0001$.

Note: Model 1, with gender as the sole predictor, is not shown. Higher gender indicates female. (R) indicates that the order of entry for SOS and CSI predictors was reversed.

But they also showed problem-solving coping to have a direct influence on attrition, separate from that of stress overload.

Test of Hypothesis 2

Zero-order correlations (Table 2) indicated that only one of the three coping strategies (AV) had an association with SOS-S scores. To examine whether this pattern changed after removing the potential confound, partial correlations were employed. Controlling for Gender, AV still correlated significantly with the SOS-S, *partial* $r = .45$, $p < .0001$, 95% CI [.40, .49], while PS (*partial* $r = -.03$, $p = .39$) and SS (*partial* $r = -.04$, $p = .20$) still did not. This finding supports Hypothesis 2, showing that coping strategies related differentially to stress overload. But unexpectedly, only one strategy, avoidance, showed a significant relationship.

Tests of Hypothesis 3

Structural Equation Modeling (SEM) was used to test whether stress overload mediated the relationship of coping to academic outcomes. For these analyses, a latent variable, formed from the observed Cumulative GPA and Attrition variables, was created to reflect overall academic performance. A model with the SOS-S as the mediator (Figure 1, Model 1) demonstrated a good fit to the data. Although the chi-square value for the model was significant ($\chi^2 = 35.47$, $df = 8$, $p < .001$), the fit indices were respectable (*GFI* = .990, *CFI* = .963), and the residual variance was acceptable (*RMSEA* = .05, *SRMR* = .04). To determine if the alternative model (Figure 1, Model 2) fit the data equally well, a second test was performed. The model with coping as the mediator did not fit the data very well. Its chi-square value was significant ($\chi^2 = 131.54$, $df = 7$, $p < .0001$), its goodness of fit indicators were moderate to weak (*GFI* = .965, *CFI* = .833), and the unexplained variance exceeded recommended limits (*RMSEA* = .12, *SRMR* = .09). In short, the model consistent with stress theory proved superior by multiple criteria; however, these criteria also indicated that there was room for improvement.

Modification indices were used to adjust the theory-consistent model to maximize its fit. Instead of a single latent variable to represent academic performance, separate path models were constructed for Cumulative GPA and Attrition. This permitted differences in the models according to the outcome under consideration. Figure 2 shows the best-fitting model for predicting GPA.

Although its chi-square value was significant ($\chi^2 = 13.93$, $df = 6$, $p = .03$), its fit indices were respectable (*GFI* = .995, *CFI* = .981), and the residual variance was reasonable (*RMSEA* = .03, *SRMR* = .03). This model retained one pathway from the original: The association of AV coping to GPA was still mediated by SOS-S scores, with strong links between avoidance and stress overload ($\beta = .46$, $p < .0001$) and between stress overload and grades ($\beta = -.17$, $p < .0001$). However, a new and direct connection between SS coping and GPA emerged, with greater use of social support relating to better grades ($\beta = .08$ $p < .003$). In contrast, PS coping, despite its significant covariance with SS, showed no relationship–direct or indirect–to GPA. Thus, this model was consistent with Hypothesis 3 only for avoidance; contrary to expectations, seeking support did not achieve its impact by lowering stress overload, and problem solving did not relate to either stress overload levels or grades.

The best model for predicting Attrition may be seen in Figure 3. The fit of this model was very good, as evidenced by a non-significant chi-square ($\chi^2 = 15.14$, $df = 9$, $p = .09$), strong fit indices (*GFI* = .996, *CFI* = .992), and little unexplained variance (*RMSEA* = .02, *SRMR* = .03). It showed, as before, AV to impact grades indirectly through the SOS-S, and SS to impact them directly. But it was only by affecting Cumulative GPA that these strategies influenced the decision to withdraw, with lower GPAs strongly linked to greater Attrition ($\beta = -.26$, $p < .0001$). In contrast, PS emerged as a significant and direct predictor of Attrition, with greater use of the strategy increasing the likelihood of dropping out later on ($\beta = .09$, $p < .001$). Again, this model was only partially supportive of Hypothesis 3: It was consistent with stress theories in showing a mediated effect for avoidance, but deviated in showing other strategies to affect academic outcomes independently of any effect on stress overload.

Discussion

Previous studies of stress and coping in college populations have not yielded consistent results. The premise of the present study was that greater fidelity to stress theories might clarify the effects in relation to academic performance. It is not surprising, then, that the results obtained here in some ways replicated, and in other ways departed from, previous findings.

Because theories indicate the destructive form of stress to occur at the juncture of impinging demands and insufficient resources, a measure of stress overload that combines both facets was used here. This is in contrast to prior studies that either failed to measure stress (e.g. Pritchard, Wilson, and Yamnitz 2007), or used measures that address only one facet or the other (e.g. Ji and

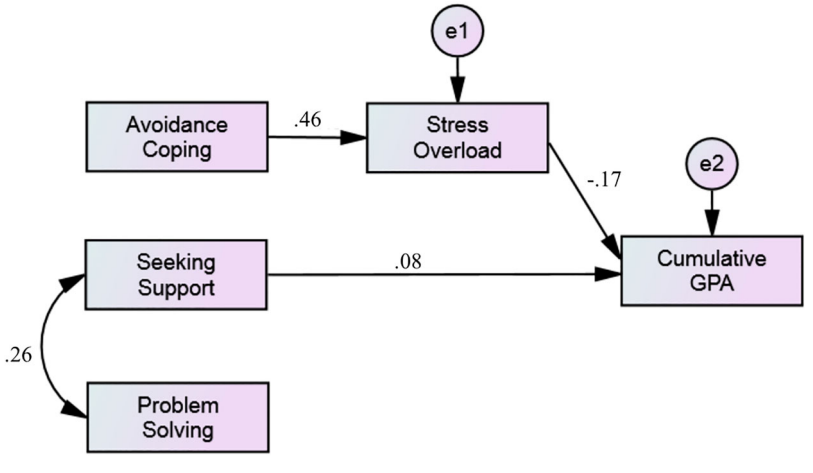


Figure 2. Best model obtained for predicting Cumulative GPA, showing standardized regression coefficients (all *ps* < .01).

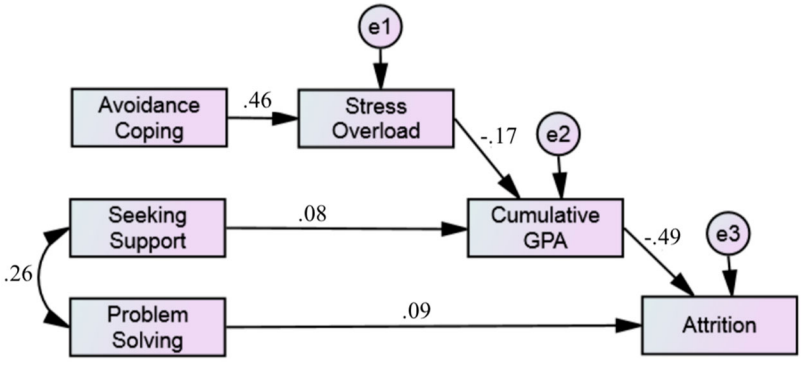


Figure 3. Best model obtained for predicting Attrition, showing standardized regression coefficients (all *ps* < .01).

Zhang 2011; Maddi et al. 2009). Nevertheless, current results corroborated previous ones (e.g. Amirkhan and Kofman 2018) by showing stress to impact grades and, through grades, attrition.

Theories also indicate that the measurement of coping is essential to determining the level of stress: ' … stress is apt to be greater when coping is inept, and effective coping may prevent or mitigate stress reactions' (Lazarus 1990, 6). Here, avoidant coping was found to be associated with greater stress overload and poorer performance, consistent with prior indications of its detrimental effects (e.g. Abdullah et al. 2010). However, counter to precedent (e.g. Britt-Lutter et al. 2017), problem solving was found ineffectual in terms of either stress reduction or enhanced performance.

Theories imply that stress is the aftereffect of failed coping (Lazarus 1990; Selye 1956), in contrast to assumptions that it precedes coping in the causal chain producing academic outcomes (e.g. Shields 2001). The current study tested both sequences and found the theoretical one to better fit the data. But the fit was not perfect: Consistent with theory, avoidant coping was linked to greater stress overload, which in turn diminished performance. Inconsistent with theory, seeking-support and problem-solving strategies directly impacted academic performance, without any intermediary effect on stress overload.

Theorists specify that the goal of coping is to prevent demands from escalating to a pathogenic level, whether that level is called 'exhaustion' (Selye 1956), 'threat' (Lazarus and Folkman 1984), or 'stress overload' (Amirkhan 2012). But in the academic context, there are desired outcomes other than stress reduction. For example, there are achievement goals, which may be roughly dichotomized as learning-oriented, aimed at mastery and skill acquisition, or performance-oriented, aimed at positive evaluations (Eppler and Harju 1997). More complex taxonomies have evolved (Pekrun, Elliot, and Maier 2009), but all agree that achievement goals (1) elicit different behavior patterns, and (2) have differential effects on academic performance. In general, learning goals are associated with problem-solving and persistence, and performance goals with avoiding difficult tasks and retreating from obstacles (Eppler and Harju 1997). These behaviors, in turn, lead to different academic outcomes, learning goals being more reliably associated with success (Eppler and Harju 1997). It may be seen, then, that achievement-directed behaviors mimic coping behaviors, both in form (problem-focused vs. avoidance) and effect (enhancing or undermining academic performance). Yet the two types of behaviors are clearly distinct, not only in purpose but also experientially. That is, achievement behaviors are accompanied by feelings such as enjoyment, boredom, anger, hope, pride, anxiety, hopelessness, and shame (Pekrun, Elliot, and Maier 2009), which overlap minimally with coping-related emotions of tension-relief, self-blame, and feeling wishful, at risk, or in control (Folkman and Lazarus 1985).

In applying stress theory to the prediction of academic outcomes, then, there is a possibility that measures may mistake achievement behaviors for coping behaviors. In the present results, this might explain the direct associations between coping and outcomes. In regard to seeking support, students

who participated in study groups (a behavior consistent with learning goals) would likely endorse coping items such as 'talked to people … ' and 'went to a friend … about the problem'. This could account for the direct association–without the intermediary of stress-overload reduction–found between seeking-support coping and higher grades. Likewise, students who are perfectionistic in their work (a behavior consistent with performance goals) might well agree with items like 'Set some goals for yourself … ' or 'Turned your full attention to solving the problem'. Because perfectionism has been linked to poor college adjustment (Pritchard, Wilson, and Yamnitz 2007), this could explain how problem-solving coping related directly to dropping out.

Limitations

Such measurement ambiguities underscore the necessity of assessing stress in academic contexts, rather than assuming its presence. Because the present study measured stress overload, it was possible to determine that some coping strategies impacted academic performance through that medium while others did not. However, in hindsight, it would have been beneficial to assess achievement goals as well, to determine if they indeed mediated the impact of the other strategies. Moreover, the present study did not assess health status. Transposing models from the health to the academic context does not necessarily mean that health outcomes are left behind; it may well be that poor coping lead to illness, which in turn impaired academic performance. This is unlikely in regard to attrition, since poor health accounts for only a small proportion of college dropouts (Grizzell and McNeil 2007), but health status has been associated with college grades (DeBerard, Spielmans, and Julka 2004).

The inclusion of such additional variables foretells increasing complexity in the temporal model linking stress and coping to academic outcomes. The study design used here was only partially longitudinal, assessing predictors concurrently and outcomes at a later time. Conclusions regarding the sequencing of coping and stress overload are therefore only probabilistic–the possibility of reverse or alternate causalities was not eliminated. More definitive conclusions will require multiple assessment points to verify the order of stress and coping, as well as the timing of any additional predictors, in the chronology.

Finally, although the current sample was large, it was limited to first-year students at a public and minority-serving university. Moreover, the majority were first-generation college attendees, who differ in grades and some coping choices from other students (Mehta, Newbold, and O'Rourke 2011). This has implications for generalization of current findings to dissimilar student populations, and even for the findings themselves. Owing the university's high retention rate, limited variability on the attrition variable could have precluded the discovery of additional links to that outcome in the present analyses.

Conclusion and implications

The present study built upon past research on stress in students by imposing a strict interpretation of theory in the hopes of clarifying inconsistent prior findings. In fact, it showed past studies that had conceptualized stress as an outcome, rather than an instigator, of coping were probably more accurate in depicting the stress-and-coping process in the academic context. It also indicated that avoidant coping impacted academic outcomes by inducing stress overload, whereas problem-solving and seeking-support strategies might have different mechanisms. Certainly, this model requires replication and refinement, but such research would seem well worth the effort, given its theoretical and practical implications.

In regard to theory, present results indicate that the 'medical model' of stress and coping does not fit seamlessly into the study of academic performance. Additional efforts will be needed to further delineate the spheres of generalization for stress-and-coping models, and to identify the variables critical to each sphere. In terms of practice, a refined model of student stress and coping could

benefit university retention programs. It would indicate essential characteristics of the at-risk student, such as a high stress overload or avoidance score, thereby improving the targeting of such programs. It could also inform the programs themselves, suggesting the most fruitful avenues for intervention. These might include assertiveness training to reduce demand load, empowerment exercises to boost perceived resources, or behavioral techniques to extinguish avoidant and reinforce support-seeking coping responses.

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