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## Lower Socioeconomic Status is Related to Poorer Emotional Well-being Prior to Academic Exams

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### Abstract

**Background:** People of lower social status tend to have greater emotional responses to stress. The present study assessed whether lower social status was related to greater emotional responses in anticipation of a naturalistic stressor: academic exams among college students.

**Methods:** College students in an introductory statistics class ( $N = 252$ ; 75.81% female; 18.41% Latino, 25.10% White, 43.93% Asian, 12.56% different racial backgrounds) completed two course exams as part of this naturalistic pre- post-experimental design. They provided four reports of positive, depressive, and anxious emotion—one the day before and one immediately after each exam.

**Results:** As hypothesized, multilevel models (ratings nested within participants) predicting emotion indicated that students with lower mother's education had less positive emotion, more depressive emotion, and more anxious emotion the day prior to academic exams than students with higher mother's education (proportional reductions in variance [PRV] = .013–.020). Specifically, lower mother's education was associated with poorer well-being before but not after the exam. Exploratory models revealed that differences in emotion by mother's education were strongest for students with lower exam scores (PRV = .030–.040).

**Conclusions:** Socioeconomic status may influence college students' anticipatory distress prior to academic exams, which may impact health and academic performance.

### Keywords

Affect; affective reactivity; emotion reactivity; emotion responses; test-taking

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“When I first arrived at school as a first-generation college student, I didn't know anyone on campus except my brother. I didn't know how to pick the right classes or find the right buildings. I didn't even bring the right size sheets for my dorm room

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**Supplemental Materials:** Supplemental Materials can be found with the study pre-registration at <https://osf.io/kaf5x/>.

bed. I didn't realize those beds were so long. So I was a little overwhelmed and a little isolated.”

—Michelle Obama, College Opportunity Summit 2014

Social status, or one's standing and access to resources, has long-term effects on students' well-being. Social status is generally measured with respect to income and education—as people with higher socioeconomic standing tend to have more resources—or through subjective reports of one's standing relative to others in society (Hoebel & Lampert, 2020). Lower social status is also related to increased stress among college students, even though pursuing education positions these students to attain higher social status (e.g., Nguyen-Michel et al., 2006). Social status has been posited to impact well-being by shaping individuals' daily emotions and emotional responses to stress (Gallo & Matthews, 2003). In the current study, we examine the influence of social status on emotional response to a naturalistic stressor that college students regularly face, academic exams, during the onset of the COVID-19 pandemic.

## Socioeconomic Status and Emotional Responses to Daily Stress

The Reserve Capacity Model posits that people of lower social status may experience more negative emotion and less positive emotion, and that these differences in emotion may contribute to existing disparities in well-being (Gallo & Matthews, 2003). Socioeconomic disadvantage often imposes more challenging and unpredictable life circumstances, including more frequent stressful life events and daily hassles, as well as fewer resources to cope (Grzywacz et al., 2004; Hoebel & Lampert, 2020). Consequently, emotion regulation is especially important for the well-being of low-income individuals (e.g., Troy et al., 2017).

In addition to experiencing more stressors, people of lower social status may interpret stressors more negatively and consequently show greater emotional responses to stress. People of lower social status often view the world as more threatening and report greater perceived stress (Gallo et al., 2005; Nguyen-Michel et al., 2006). Because of these threat perceptions, children and adults of lower income tend to be more sensitive to negative social cues and tend to interpret neutral circumstances as threatening compared to peers with higher income (Chen et al., 2004; Kraus et al., 2011). Relative to people of higher social status, people of lower social status show greater threat-related neurobiological responses to laboratory acute stress and greater reductions in positive emotion on days they experience more demands (Gallo et al., 2005; Gianaros et al., 2008; Rahal et al., 2019). Taken together, greater emotional and cognitive responses to stress may negatively impact well-being for individuals from lower status backgrounds.

## Academic Stress

Academic exams are stressful for students because of their impact on students' time, study efficiency, and exam performance (Stowell, 2003). Students experience varied emotions in academic settings (achievement emotions), and can feel negative emotions (e.g., anxiety about taking the exam, hopeless or depressive about their ability to master material) and positive emotion (e.g., relief post-exam) regarding test-taking (Pekrun et al.,

2011). According to the Self-Regulation Learning Model, students recognize they have an academic exam (forethought), complete the exam (performance), and then evaluate their performance and completion of the exam (self-reflection; Pintrich, 2000). Students generally show greater psychophysiological stress both during weeks of intensive academic exams and right before completing an academic examination on a given day (Preuß et al., 2010; Weekes et al., 2006). Furthermore, in line with attentional control theory (Eysenck et al., 2007), negative emotions, particularly anxiety, can disrupt attentional systems to favor the processing of threatening stimuli (e.g., worrying about an upcoming exam) over goal-directed stimuli (e.g., studying). Negative emotions experienced prior to and during exams can undermine academic performance, and thereby promote further negative emotional well-being (e.g., Pelch, 2018).

Educational psychology has established that dispositional factors that students bring to the classroom—including students' socioeconomic status—can impact their attitudes, cognitions, and emotions regarding academics (e.g., Pintrich, 2000). For students of lower social status, who may be more inclined to interpret stimuli as threatening (e.g., Kraus et al., 2011), stress from an upcoming exam may be particularly deleterious. Yet, research is needed to identify social status-based differences in students' emotional responses to upcoming academic exams.

### **Socioeconomic Status and Responses to Unexpected Life Events**

In line with the Reserve Capacity Model, people who are of lower socioeconomic status also show more negative outcomes during natural disasters and times of extreme stress, in part because they have fewer resources to cope (Bolin & Stanford, 1991). For instance, following hurricane Hugo, individuals who were less educated received less help compared to individuals who were more educated (Kaniasty & Norris, 1995). Likewise, status-based disparities in health outcomes are often exacerbated during economic recessions (e.g., Bartoll et al., 2015).

A recent international stressor is the COVID-19 pandemic, which greatly impacted mental health (Wang et al., 2021). Although the pandemic threatened people's livelihood in varied domains (e.g., finances, loneliness), individuals of lower status backgrounds were disproportionately more likely to both contract the virus and experience financial strain (Clouston et al., 2020; Lamb et al., 2020). Adolescents from lower education households also reported greater stress related to their family and mental health compared to youth from more educated households (Villaume et al., 2021). Similar results may emerge for college students, a group who experienced academic concerns and showed persistent negative emotional well-being during the pandemic (Hawes et al., 2021). Facing these challenges may have required additional coping resources, leaving even fewer resources for coping with daily stressors in line with the Reserve Capacity Model. Yet, it remains unclear how socioeconomic status relates to college students' emotional responses to academic stress, especially during the COVID-19 pandemic.

## Present Study

The present study investigated whether social status related to college students' emotional responses to academic exams during the COVID-19 pandemic. Despite research regarding students' self-regulation (i.e., strategies for academic learning) and stress regulation (i.e., ability to control internal psychobiological states in the context of stress), the present study specifically assessed how one dispositional factor—socioeconomic status—related to changes in emotion in the form of emotional reactivity to academic exams, an ecologically valid stressor. We attempted to minimize variations across courses regarding timing and exam difficulty by recruiting students from the same class. Socioeconomic status was assessed as a student-level distal factor that may predict emotional well-being (indicated by positive, depressive, and anxious emotion) regarding upcoming academic exams. Students rated their emotion the day before each exam and shortly after each exam, such that we could assess how timing (prior or after exam) affects emotions and better understand the students' emotional experiences with upcoming academic exams.

We tested whether changes in emotion between the day before and immediately after an exam varied by two indicators of social status: mother's education, as a proxy for socioeconomic status, and subjective social status, or one's own appraisal of their standing in society. Both measures have been well-validated as distinct measures of status that robustly relate to health (e.g., Quon & McGrath, 2014), and the effects of social status can be rigorously examined by testing both subjective social status and socioeconomic status (Hoebel & Lampert, 2020). Given the extant literature regarding academic anxiety and achievement emotions (Pekrun et al., 2011; Preuß et al., 2010; Weekes et al., 2006), students were generally predicted to show greater anxious and depressive emotion and less positive emotion in anticipation of an exam (i.e., pre-stressor) relative to after (i.e., post-stressor).

Further, we hypothesized that students of lower social status would be more negatively impacted by an anticipated exam—as indexed by more negative emotion and less positive emotion before relative to after the exam—because people of lower social status tend to show greater emotional responses to threat (e.g., Chen et al., 2004; Gallo et al., 2005; Rahal et al., 2019). In turn, students of higher social status were hypothesized to show relatively smaller changes in emotion between before and after the exam. Second, we explored whether associations between students' social status and emotional responses varied by students' performance on the exam, and we hypothesized that students with lower social status and poorer exam scores would show poorer well-being before relative to immediately after the exam.

## Method

### Participants

Participants comprised 252 undergraduate students enrolled in an introductory statistics class at a large public university. Of these participants, 239 completed the initial survey and reported mother's education, 230 completed the final survey and reported subjective social status, and 221 completed both surveys. Most participants were female (75.81%) or male (23.79%). No participants identified as non-binary or reported preferring another gender

identity, and one participant preferred not to report their gender. Most participants identified as either Latino (18.41%), White (25.10%), or Asian (43.93%). The majority of participants were in either their second (63.09%) or third (28.33) year of college. Almost half of the participants reported working at jobs for more than 10 hours per week during the academic year (42.21%). We had aimed to recruit at least 150 participants, consistent with sample sizes from prior studies of social status and emotional responses to stress (i.e., Gallo et al., 2005; Rahal et al., 2019).

## Procedure

Students reported demographic information, including mother's education, at the start of the ten-week course. The course included five academic exams. The fourth exam, which was administered to students during the eighth week of the quarter, and the fifth exam, administered after the tenth week of the quarter, were included in the current study. Participants' grades for each exam were recorded. The exams were conducted using Jupyter Notebooks and required students to answer conceptual questions (multiple-choice and open-ended responses), run R code to fit statistical models, make plots from datafiles, and interpret parameter estimates. Students participated in the study for extra credit, and reported their emotion the day before and immediately after each of the two exams. Study procedures were part of a larger project which was declared exempt by the local Institutional Review Board due to its focus on normal educational processes, and students had the option to allow their data to be included in research.

## Adjustments due to the COVID-19 Pandemic

This study was conducted between February 27 and March 15, 2020. Aspects of the study were adjusted given emerging concerns regarding the COVID-19 pandemic, and the institution's required transition to remote instruction occurred on March 10, 2020. We had initially aimed to administer the study across three academic exams, and collect emotion ratings on days that were not related to the exams to attain a valid baseline emotional state. However, the course instructor requested we wait until the end of the quarter, in hopes that concerns regarding the COVID-19 pandemic would lessen over time. Therefore, we administered four emotion ratings based around the last two of the five academic exams. Both exams were administered remotely online, whereas students completed the earlier exams on their laptop while in the classroom. Due to the COVID-19 pandemic, participants reported self-rated health each week and reported the degree to which their emotion was negatively affected by the COVID-19 pandemic and the related transition to online instruction in the final survey, and these ratings were included as covariates in analyses. In spite of the circumstances, there was no significant difference in the number of completed surveys between before and after the official transition to remote-learning ( $\chi^2[1] = 1.41, p = .24$ ).

## Measures

**Emotion.**—Participants rated their emotion 'right now' on scales from 1 (*Very slightly or not at all*) to 5 (*Extremely*). Positive emotion was assessed using two items (cheerful, happy). Participants rated depressive emotion using three items (discouraged, hopeless,

sad) and anxious emotion using four items (nervous, on edge, uneasy, worried), taken from the depression and anxiety subscales of the Profile of Mood States (McNair et al., 1989). Ratings of poorer daily well-being using these abbreviated scales have been related to greater rejection sensitivity and more daily conflict, interpersonal stress, and peer victimization (Chung et al., 2009; Espinoza et al., 2013; Kiang et al., 2006). Items were averaged for each subscale, and all subscales showed good reliability across the four ratings ( $\alpha$ s=.76–.84 for positive emotion;  $\alpha$ s=.79–.86, McDonald's  $\omega$ s=.80–.93 for depressive emotion; .88–.93, McDonald's  $\omega$ s = .88–.91 for anxious emotion).

**Mothers' education.**—Students rated their mother's highest level of education according to the following scale: *1 = elementary or middle school, 2 = some high school, 3 = high school graduate, 4 = post high school vocational training, 5 = some college, 6 = associate's degree, 7 = bachelor's degree, 8 = post graduate degree (master's, doctorate, etc.)*. Students could also report that they did not know their mother's level of education.

**Subjective social status.**—Students completed the MacArthur Scale of Subjective Social Status—Youth Version, in which they were presented with a ladder with 10 rungs and asked:

Imagine that this ladder pictures how American society is set up. At the top of the ladder are the people who are the best off – they have the most money, the highest amount of schooling, and the jobs that bring the most respect. At the bottom are people who are the worst off – they have the least money, little or no education, no job or jobs that no one wants or respects. Now think about your family. Please tell us where you think you and your family would be on this ladder.

This scale has been well-validated as a single-item indicator of social status, and lower values have been consistently related to poorer health outcomes (e.g., Quon & McGrath, 2014).

### **Covariates and Descriptive Variables.**

**Course stress.:** Students rated how challenging (“This course is too stressful for me”), costly (“I have to give up too much to do well in this course”), and stressful (“This course was challenging”) they found the course on scales from *1 (Strongly Disagree)* to *5 (Strongly Agree)*.

**COVID-19 impact on emotion.:** Students reported the degree to which they felt that their emotion was affected by the COVID-19 pandemic and recent containment measures (e.g., social distancing, online learning) on a Likert scale from *1 (Not at all)* to *5 (Very Much)*.

**Race.:** Participants self-reported race at the start of the course using the following options: African American, White, Asian, Latino/Hispanic, Other.

**Gender.:** Participants self-reported gender at the start of the course using the following options: male, female, nonbinary/other/prefer not to answer.



**Self-rated health.:** On the two surveys conducted right after the exams, participants rated their general health over the past week on a scale from 1 (*Poor*) to 5 (*Excellent*) using an item from the Medical Outcomes Study 36-item health survey (Ware & Sherbourne, 1992).

### Analytic Strategy

Because participants provided multiple ratings of emotions across the study, we used multilevel models, with emotion ratings nested within participants, to examine how students' emotional responses varied between the day before the exam and shortly after completing the exam. Multilevel models were used because they allowed for missing data at the level of ratings, such that participants were included in the analysis if they completed at least one emotion rating. We also tested whether the number of observations differed by demographic characteristics, as significant differences in the number of observations could suggest that estimated associations were more accurate for certain groups. These models also allow for random intercepts, as each participant likely has a different baseline level of emotion, and random effects so that the degree to which students' emotion differed by time could also randomly differ across participants. All models met statistical assumptions: Distributions for emotion outcomes were generally normal, with low to moderate skewness ( $-.01 - .96$ ; all values below  $|2|$ ) and acceptable levels of kurtosis ( $1.93 - 3.78$ ; all values below  $|7|$  in line with current guidelines; Kline, 2015), and residuals at each level were consistently normally distributed and unrelated to predicted values. Multilevel models do not assume normality regarding predictor distributions, although skewness and kurtosis of predictor variables can be viewed in Table S2.

First, models assessed how emotion changed before and after the exam, controlling for which exam students were completing and students' score on the exam. Models then tested whether emotional responses to the exam varied by mother's education by including the cross-level Test Day (i.e., before vs after the exam)  $\times$  Mother's Education interaction (Equation 1).

$$\widehat{Affect}_{ij} = \beta_0 + u_{0j} + (\beta_1 + u_{1j})(Test\ Day) + \beta_2(Mother's\ Education) + \beta_3 (Test\ Day)(Mother's\ Education) + \beta_4(covariates) \quad 1)$$

All models included random intercepts and random slopes for Test Day. As an exploratory analysis, models examined whether these associations varied by students' performance on the exam by including a Test Day  $\times$  Mother's Education  $\times$  Exam Score three-way interaction (Equation 2). Interactions were probed using simple slopes to model how the effect of Test Day varies at low (i.e., one standard deviation below the sample average), average, and high (i.e., one standard deviation above the sample average) levels of mother's education and exam score.

$$\widehat{Affect}_{ij} = \beta_0 + u_{0j} + (\beta_1 + u_{1j})(Test\ Day) + \beta_2(Mother's\ Education) + \beta_3 (Test\ Day)(Mother's\ Education) + (\beta_4 + u_{2j})(Exam\ Score) + \beta_5(Test\ Day)(Exam\ Score) + \beta_6(Mother's\ Education)(Exam\ Score) + \beta_7(Test\ Day)(Mother's\ Education)(Exam\ Score) + \beta_8(covariates) \quad 2)$$



To assess robustness of results, analyses were repeated controlling for gender and race. Because data were collected shortly before quarantine was imposed by the state to reduce the spread of COVID-19, analyses also controlled for students' general health over the prior week and the degree to which students rated that the pandemic had influenced their emotion. Finally, to rigorously test results across indicators of social status, all analyses were repeated using a subjective indicator of status—subjective social status—instead of mother's education.

Timing of exams was dummy-coded using two variables: one with respect to whether students reported emotion the day before or immediately after each exam (0 = pre-exam, 1 = post-exam) and the second with respect to the exam (0 = fourth exam, 1 = fifth exam). Scores for each exam were separately standardized. Mother's education and subjective social status were treated as continuous variables. Gender and race were dummy-coded (male = 0, female = 1; White as reference group, compared with Asians, Latinos, and people of other races or biracial). Health and the impact of the COVID-19 pandemic on emotion were measured continuously and grand-mean centered. Syntax and pre-registration of analyses are provided at <https://osf.io/kaf5x>.

## Results

### Descriptive Statistics of Study Variables

The majority of participants reported that their mother had a Bachelor's degree or higher (50%), although 18% of participants reported their mother's had received some post-high school education (vocational training, associate's degree, or some college) and 27% reported that their mother had either completed middle school, some high school, or all of high school (see Supplemental Table S1 for more details). Participants on average reported above the midpoint of subjective social status,  $M = 6.23$ ,  $SD = 2.00$ . Students with more educated mothers had higher subjective social status,  $t(218) = .55$ ,  $p < .001$ . Most participants completed all four assessments of emotion ( $n = 187$ , 74.21%), with 920 observations across the study. When examining whether the number of observations differed by demographic characteristics, we found that the number of completed assessments of emotion did not vary by race, health, and self-reported impact of the COVID-19 pandemic on emotion. However, female students ( $M = 3.77$ ,  $SD = 0.54$ ) completed more assessments than male students ( $M = 3.43$ ,  $SD = 0.82$ );  $t(230) = 3.44$ ,  $p < .001$ .

Students performed well on average on the two exams ( $M_{\text{Fourth Exam}} = 88.09$ ,  $SD = 12.17$ , range 47–100;  $M_{\text{Fifth Exam}} = 91.72$ ,  $SD = 5.52$ , range 69–100). Both higher mother's education and subjective social status were associated with higher scores on both academic exams,  $r_s = .15 - .35$ ,  $p_s = .001 - .03$ . Using 5-point scales, students reported that the course was challenging ( $M = 3.81$ ,  $SD = 0.97$ ), but not too stressful or costly ( $M = 2.67$ ,  $SD = 1.21$ ;  $M = 2.53$ ,  $SD = 1.19$ , respectively). Students with lower mother's education and lower subjective social status found the course more challenging, stressful, and costly,  $r_s = (-.14 - -.24)$ ,  $p_s = .0004 - .02$ .

The majority of students reported that their emotion was strongly impacted by the COVID-19 pandemic and the implemented policies, with 56.02% rating the impact as

5, the scale maximum;  $M = 4.28$ ,  $SD = 0.94$ . Many students noted uncertainty, social disconnection, and academic problems as common stressors. These reports did not vary by students' reports of mother's education or students' exam performance,  $ps > .09$ . Descriptive statistics of participants' emotion, exam scores, and health ratings can be found in Supplemental Table S2.

We next examined whether there were changes in emotion from before to after the exam, controlling for exam and score on the exam. Multilevel models predicted each form of emotion from whether students experienced a test that day. As expected, we found higher levels of depressive and anxious emotion the day before the exam than immediately following the exam,  $B = -0.10$ ,  $SE = 0.05$ ,  $p = .027$ ;  $B = -0.15$ ,  $SE = 0.05$ ,  $p = .006$ , respectively, although positive emotion did not change from before to after the exam,  $B = 0.02$ ,  $SE = 0.05$ ,  $p = .74$  (see descriptive Supplemental Figures S1–S3). Also, exam scores were consistently unrelated to emotion, and there was more negative emotion and less positive emotion during the fifth exam than during the fourth exam, all  $ps < .03$  (Supplemental Table S3).

### Emotion as a Function of Mother's Education and Test Day

To test whether social status modified the degree to which students' emotions were affected by exams, models tested the cross-level Test Day (i.e., day before versus exam day)  $\times$  Mother's Education interaction as a predictor of emotion. Mother's education significantly influenced the degree to which students' positive emotion and depressive emotion, but not anxious emotion, changed between the day before and the day of the exam (Table 1, Model 1).

For these models, simple slopes were probed at low (i.e., one standard deviation below the sample average), average, and high (i.e., one standard deviation above the sample average) levels of academic performance. Simple slopes indicated that lower mother's education was related to less positive emotion and more depressive emotion the day before the exam, but mother's education was not related to emotion immediately after the exam. Students with lower levels of mother's education showed significant increases in positive emotion between the day before and immediately following the exam, whereas individuals with mean and high levels of mother's education showed no changes in positive emotion (Fig. 1a). For depressive emotion, students with lower mother's education showed greater changes in depressive emotion, such that they had significantly larger reductions in depressive emotion following the exam relative to individuals with mean or higher levels of mother's education (Fig. 1b).

Because emotion can vary by demographic factors and academic performance can be negatively impacted by poor health, we tested the robustness of results by covarying gender, race, health, and self-reported impact of the COVID-19 pandemic on emotion. The Test Day  $\times$  Mother's Education interactions for positive emotion and depressive emotion remained significant (Table 1, Model 2). For anxious emotion, the Test Day  $\times$  Mother's Education interaction emerged as significant after adjusting for covariates,  $B = 0.05$ ,  $SE = 0.02$ ,  $p = .036$ . The pattern was similar to that for depressive emotion; lower mother's education corresponded to greater changes in anxious emotion, such that students with lower mother's

education had significantly higher levels of anxious emotion the day before the exam relative to individuals with mean or higher levels of mother's education (Fig. 1c). All associations remained significant when controlling for average performance on previous exams.

### Emotion as a Function of Mother's Education, Exam Score, and Test Day

Although previous analyses suggested that students with lower social status showed greater changes in emotions between the day before and right after the exam, exploratory analyses tested whether associations between social status and emotion varied by students' performance on the exam. Specifically, we included a three-way Test Day  $\times$  Mother's Education  $\times$  Exam Score interaction as a predictor of each emotion.

The three-way interaction was significant for positive emotion,  $B = 0.04$ ,  $SE = 0.02$ ,  $p = .047$ , and depressive emotion,  $B = 0.05$ ,  $SE = 0.02$ ,  $p = .021$ . Simple slopes analyses suggested that the effect of mother's education on changes in positive emotion from before to after the exam was primarily driven by students with lower exam scores (Fig. 2a). For students with lower exam scores, mother's education was related to changes in emotion, such that those with lower mother's education reported less positive emotion the day before the exam. For students with average or higher exam scores, mother's education was not related to changes in emotion.

Similarly, students who performed worse on the exam showed greater changes in depressive emotion between before and after the exam (Fig. 2b). Among students who did worse, students with lower mother's education showed significant decreases in depressive emotion from the day before to after the exam, whereas students with average or high mother's education did not show changes in depressive emotion. Again, students who performed well did not report significant changes in depressive emotion, regardless of mother's education. Both the three-way interactions for positive emotion and depressive emotion remained significant after controlling for gender, race, health, and self-reported impact of the COVID-19 pandemic on emotion (Supplemental Table S4). Importantly, three-way interactions between test day, mother's education, and performance on previous academic exams were non-significant for each emotion.

### Emotion as a Function of Subjective Social Status

Whereas the previous models used mother's education as a proxy for social status, analyses were repeated using subjective social status. Subjective social status is a related but fundamentally distinct indicator of status and was moderately to strongly related to mother's education,  $r(218) = .55$ ,  $p < .001$ . These analyses were conducted to examine whether results were robust across both mother's education and subjective measures of social status. First, we tested Test Day  $\times$  Subjective Social Status interactions to examine whether emotional responses varied by subjective social status. There was no effect of subjective social status on changes in positive or anxious emotion,  $ps > .05$ . Similar to the effect for mother's education, only students with lower subjective social status showed significant changes in depressive emotion,  $B = 0.05$ ,  $SE = 0.02$ ,  $p = .041$ . Students with higher subjective social status showed no changes in depressive emotion between before and after the exam. However, unlike the effect of mother's education, the Test Day  $\times$  Subjective Social Status

interaction for depressive emotion was no longer significant after controlling for gender, race, health, and self-reported impact of the COVID-19 pandemic on emotion,  $B = 0.04$ ,  $SE = 0.02$ ,  $p = .080$  (Supplemental Table S5).

Three-way Test Day  $\times$  Subjective Social Status  $\times$  Exam Score interactions tested whether the effect of subjective social status on changes in emotion varied by students' performance on the exam. The three-way interactions were significant in predicting depressive emotion,  $B = -0.07$ ,  $SE = 0.02$ ,  $p = .003$ , and anxious emotion,  $B = -0.07$ ,  $SE = 0.03$ ,  $p = .008$ , Supplemental Table S6. Again, the pattern of results was similar to that found for mother's education. Lower subjective social status was related to decreases in anxious and depressive emotion from before to after the exam, but only for students who performed worse on the exam (Supplemental Fig. S5). Subjective social status did not modulate changes in depressive or anxious emotion for students who earned average or high scores on the exam. The three-way interaction predicting depressive emotion remained significant after controlling for gender, race, health, and self-reported impact of the COVID-19 pandemic on emotion and when controlling for performance on previous exams, although the effect for anxious emotion was no longer significant when accounting for covariates,  $B = -0.05$ ,  $SE = 0.03$ ,  $p = .095$  (Supplemental Table S6).

## Discussion

People of lower socioeconomic status tend to be more aware of social threats (e.g., Chen et al., 2004; Kraus et al., 2011) and show greater emotional responses to daily and acute stressors (e.g., Gallo et al., 2005; Rahal et al., 2019). The present study examined whether social status impacted the degree to which college students' emotion changed between before and after a naturalistic stressor, an academic exam, during a time of unprecedented stress with the COVID-19 pandemic and the corresponding transition to remote instruction. As hypothesized, results suggested that social status influences students' emotional well-being between the day before and immediately after an exam, especially when they do poorly on the exam. When students experienced stressors that were both planned (exams) and unplanned (pandemic), students of lower social status tended to report higher anxious and depressive emotion and lower positive emotion on the day before the exam, but not after taking the exam. Similar patterns emerged across both mother's education and subjective social status as indicators of social status, albeit more consistently for mother's education. Specifically, lower mother's education was associated with greater changes in positive, depressive, and anxious emotion, with effects for positive and depressive emotion driven by low-achieving students, whereas lower SSS was associated with changes in depressive and anxious emotion among low-achieving students.

### Socioeconomic Status, Academic Exams, and Emotion

College students with lower mother's education and subjective social status showed poorer well-being than students with higher social status on the day before, but not immediately after, each exam. Because this study assessed a naturalistic, planned stressor, students of lower mother's education and subjective social status may have had greater emotional responses in anticipation of the exam. After the exam, students may have shown a decline

in negative emotion because the threat of the exam was no longer present and shown an increase in positive emotion because of either satisfaction with their performance or relief that the exam was completed. The significant results for both positive and negative emotion suggest that these distinct processes are both occurring, in line with evidence that individuals who habitually experience test anxiety before an exam often also report feeling relieved after exams (Pekrun et al., 2011).

An alternative explanation of these results is that students with lower mother's education and subjective social status may generally show poorer well-being, and that completing the exam boosted well-being for these students. This seems unlikely as exploratory analyses revealed that results were driven by students with low exam scores. Also, participants—especially those of lower mother's education and subjective social status—rated this class as challenging. Thus, it is reasonable that students with lower social status had poorer well-being in anticipation of exams, and that social status influences students' emotion on stressful rather than non-stressful days.

These results align with prior findings that daily stressors negatively impact emotion for people of lower socioeconomic status (Gallo et al., 2005; Grzywacz et al., 2004) and that the life circumstances of people with low socioeconomic status predispose them to negatively appraise stimuli (e.g., Chen et al., 2004; Gianaros et al., 2008). The present study extends these findings to academic exams, a common stressor for students. Greater distress in anticipation of academic exams may contribute to status-based disparities in health, as both persistent negative emotion and greater emotional reactivity have been related to poorer health (Gallo & Matthews, 2003). Further, negative emotion stemming from academics may spillover to impact other domains and deteriorate health, and these pathways should be further studied.

### **Exploratory Analyses of Academic Achievement**

Exploratory analyses suggested that lower mothers' education and subjective social status were related to greater changes in emotion between before and after exams primarily among students with lower exam scores. Anticipatory stress among students of lower status may have caused cognitive disruptions and reduced memory and attention (Eysenck et al., 2007), and thereby may have negatively impacted students' studying and performance on the exams (Heissel et al., 2017). Alternatively, students may have reported poorer well-being before the test because they struggled with the material and had already anticipated performing poorly. Students with lower academic performance may have viewed the test as threatening and consequently had poorer well-being the day prior, similar to how poorer math performance can temporally predict increases in math anxiety among high school students (Ma & Xu, 2004).

Effects may have been observed only among students with lower mother's education and lower subjective social status because these students may feel more pressure to perform on exams due to the financial burden of college, potential familial factors such as expectations imposed by their home community, or perceived lack of support (Bryan, & Simmons, 2009; Covarrubias et al., 2019). They may also feel less prepared for the rigorous college exams or may have fewer study skills to prepare for exams compared to students from

higher status backgrounds. Finally, emotion was reported before and after two exams. Students who achieved higher scores may have proven to themselves that they can succeed academically, which may boost academic efficacy and reduce this effect of poorer well-being in anticipation of exams.

Interestingly, although results were non-significant, the opposite pattern was apparent among low-performing students with higher mother's education. It is possible that some students felt that they understood the material while they studied and then felt distressed by their exam performance. Prior research has suggested that students can report distinct negative emotions in response to anticipated outcomes (e.g., anxiety) and reflecting on the exam (e.g., shame; Pekrun et al., 2011). Specifically, whereas students with lower mother's education may have felt distressed in anticipation of the exam and showed a discharge of negative emotion afterwards, students with higher mother's education may have reported poorer well-being after the exam because they responded negatively to the challenging exam questions. This interpretation may be supported by prior research suggesting that people of lower social status tend to be more sensitive to immediate threat compared to those of higher status (e.g., Kraus et al., 2011).

### **Context of the COVID-19 Pandemic**

Participants experienced planned exams during the stressful COVID-19 transition to remote learning. Almost all students reported that the COVID-19 pandemic impacted their emotion moderately or strongly. Students with lower mother's education did not report that their emotion was more affected by the COVID-19 pandemic than those with higher mother's education, although we used a single Likert scale to assess this phenomenon. This result aligned with a prior finding that first-generation college students reported greater academic stress but not life stress than non-first-generation college students during the pandemic, suggesting that the pandemic specifically amplified academic stress for these students (Bono et al., 2020).

Students from lower status backgrounds may have been particularly disadvantaged by the current circumstances, which provided an unprecedented additional test of the Reserve Capacity Model. Individuals of lower socioeconomic status were particularly likely to contract COVID-19 and to experience additional setbacks, including limited access to housing, income, and academic resources and technology (Clouston et al., 2020; Lamb et al., 2020). Students likely required additional resources to deal with these needs in conjunction with academic exams. However, given the rapidly changing circumstances that students experienced, reports of students' other daily stressors would be needed to truly determine whether their emotional responses were related to the academic exams versus other stressors that may have coincided with the exams.

### **Context of an Academic Stressor**

The findings of the present study contribute to understanding status-based disparities in academics. Research suggests that first-generation students and students of lower socioeconomic status often have lower academic achievement, engagement, and enrollment (e.g., Bozick & Ingels, 2008; Burkam & Lee, 2003). This existing achievement gap may



contribute to or reinforce differences in emotional responses to exams. For example, students of lower socioeconomic status may experience stereotype threat because their academic identity is more salient when completing exams (Svoboda et al., 2016). Their academic identity may be more central to them and consequently cause them to feel more threatened and emotionally reactive to an upcoming exam. As such, students with lower levels of mother's education may feel threatened by the evaluative nature of the exam and feel less capable of succeeding (Phillips et al., 2020), which can elicit distress and thereby impede students' studying (Heissel et al., 2017).

Although mothers' education and subjective social status indicated similar patterns of results for depressive emotion (i.e., students with lower social status showed more depressive emotion only the day before the exam), mothers' education predicted changes in positive and anxious emotion. Despite emotion and subjective social status both being rated through self-report, mother's education was more consistently related to changes in emotion. Students whose mothers have less formal education may be more responsive to academic stressors because they may feel less prepared; for instance, parents who did not attend college may be less able to advise and support their children regarding the college transition relative to college-educated parents (Hsiao, 1992; Terenzini et al., 1996; Zalaquett, 1999). Further research can investigate the aspects of the experiences of first-generation students that influence the stress process.

### **Implications and Future Directions**

Poorer well-being the day prior to the exam may negatively impact studying and thereby worsen academic performance by disrupting study habits and motivation to study (Pelch, 2018). Negative experiences with studying can also reduce students' desire to further engage with the material, irrespective of actual exam performance (Heissel et al., 2017). In this way, greater emotional responses may contribute to reduced long-term engagement with academic material. Self-regulation was not tested in this paper, but the Self-Regulation Learning Model could provide an opportunity to test whether these emotional responses contribute to a feed-forward mechanism for low-achieving students to struggle academically (Pintrich, 2000). Future studies should incorporate additional ratings of emotion (i.e., during the exam) and measures of students' motives, attitudes, and studying behavior to test this model. To identify pathways, future research can assess students' studying the day prior to the exam to examine whether students reported poorer well-being because of exam anticipation or because of dissatisfaction with studying. Further research can also develop interventions to reduce negative emotion in anticipation of exams—particularly among students of lower status—to improve overall emotional well-being and ensure that students are motivated to study the day before the exam.

### **Recommendations for Higher Education**

Educators can aim to improve students' well-being by reducing stress associated with exams. The high-stakes nature of college exams may distress students, and instructors may reduce this distress by having more moderate assessments that constitute a lower percentage of their grade. This may be particularly beneficial for students from lower socioeconomic backgrounds, who often experience greater cultural mismatch with the highly independent



and competitive nature of college academic exams (Phillips et al., 2020). When appropriate, instructors can reduce academic anxiety by allowing students to create a “cheat sheet” to bring to their exams, which can enable students to focus on learning rather than memorizing material (Erbe, 2007). Instructors can also share practice exams in advance to reduce uncertainty about the structure and content of an upcoming exam and allow students to earn additional points from missed questions if the student can later articulate the reasoning for the correct answer.

Instructors can also better address the needs of students from lower status backgrounds. First-generation students have reported the importance of supportive faculty for providing procedural knowledge regarding the academic experience and reducing stress (Garriott & Nisle, 2018), and instructors can encourage students to use academic resources and visit office hours by dispelling the myth that such resources are only for poor-performing students. Professors can also directly address how students’ anxiety can be neutral or even beneficial (Brady et al., 2018). Finally, college organizations should actively support first-generation and lower socioeconomic status college students during their first year to facilitate the college transition, including providing resources regarding ways to study, manage time, find tutors, and reduce anxiety.

### Limitations

The study design was limited with respect to timing and frequency of assessments. First, data were collected during the onset of the COVID-19 pandemic. Thus, students may have been emotionally reacting to stressors beyond the exam. Although we controlled for self-reported impact of the COVID-19 pandemic and containment measures on emotion, most students reported being greatly impacted, and results may be limited to students’ emotional responses to exams during highly stressful periods and should be replicated in a less stressful context. Second, the current study included primarily male and female participants. Future studies should assess gender using open-ended questions and should assess whether findings replicate in gender and sexual minorities. Interestingly, number of completed emotion ratings did not differ by any study variables besides gender. Female students may have completed more surveys than male students because they may have felt more pressure to have extra credit in a statistics class, may have been more careful to complete the ratings promptly after the exam, or varied by another factor that could contribute to completing the surveys compared to male students. Regardless, estimates of associations may be more accurate for female than for male students in this study.

Third, data were limited by rigor of assessments. The study is lacking additional information regarding students’ characteristics such as type of learning and student learning motivation which may explain observed differences in students’ emotion, and there was no additional measure of emotion collected either several days before or after the exam because of logistical constraints with data collection. Therefore, it is unclear what baseline characteristics may have influenced students’ emotional responses. Mechanistically, longer surveys may allow us to identify the source of negative emotion for students by assessing how prepared students felt and how much they studied. Lastly, data were collected in a

single course, and results may vary by other facets of a course, such as average grade, risk of failure, and course content.

## Conclusions

Students of lower social status showed poorer emotional well-being the day prior to the exam relative to students of higher social status during the COVID-19 pandemic and the immediate transition to remote learning, and they showed greater emotional changes between before and after the exam. These differences were driven by students who performed poorly on the exams. Greater emotional responses to stress may negatively impact students' well-being and ability to study prior to the exam. Further understanding of status-based differences in the emotional responses to stressors in diverse academic and non-academic contexts may illuminate pathways that contribute status-based disparities in health and academic outcomes.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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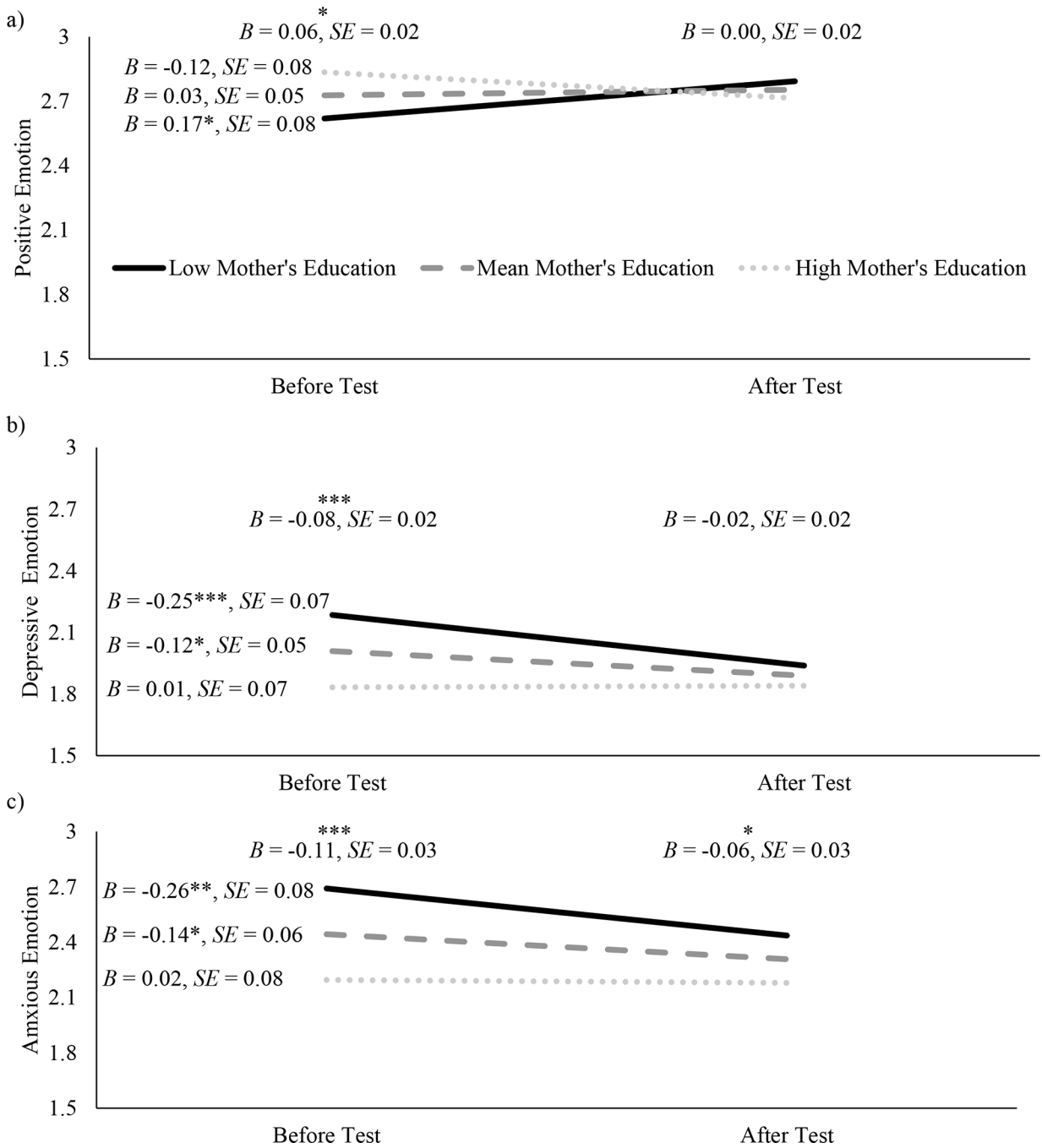
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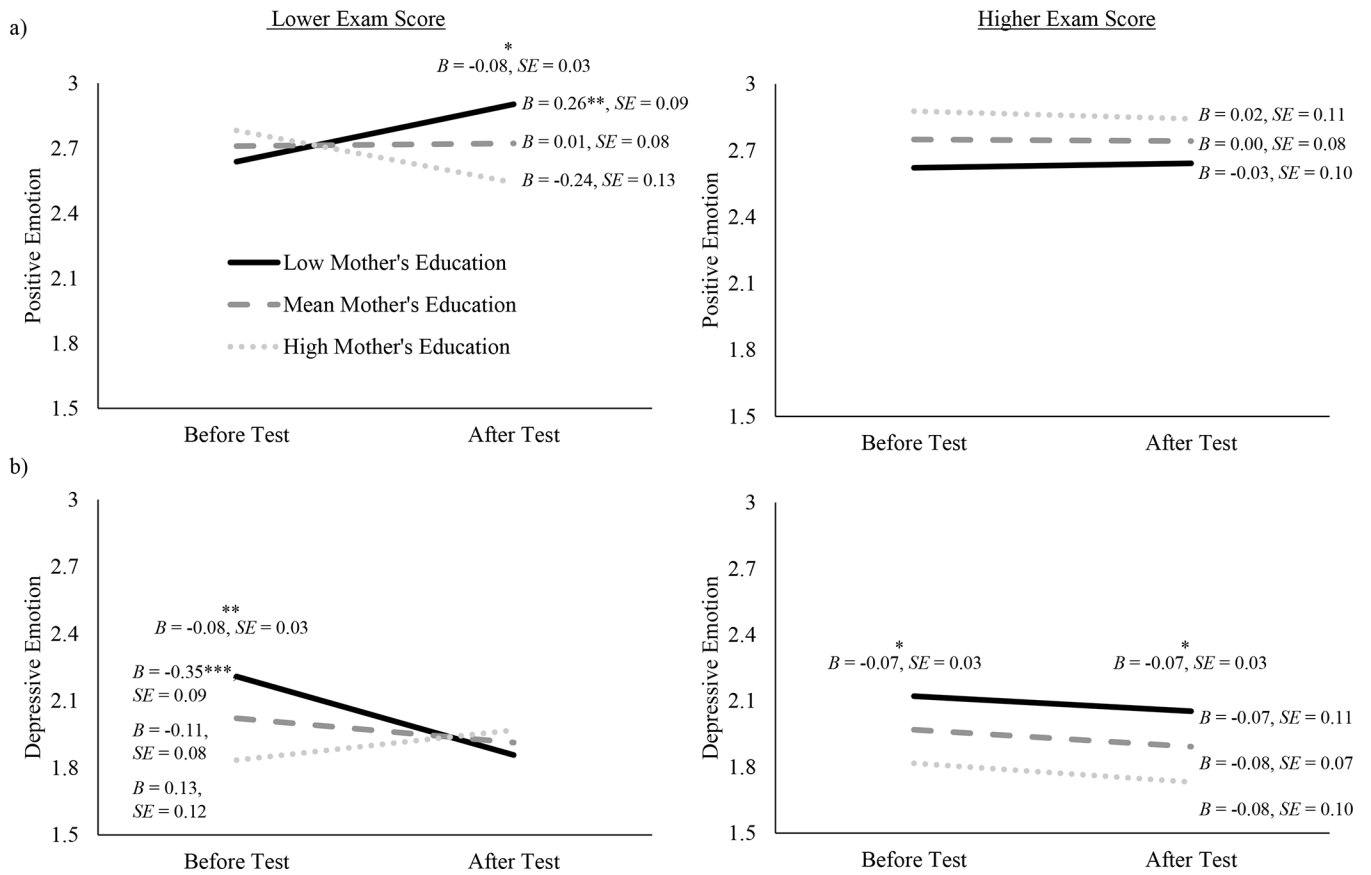
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**Figure 1.** Positive emotion (a), depressive emotion (b), and anxious emotion (c) as a function of test day (i.e., the day before versus the day of the exam) and mother’s education. Participants with lower mother’s education show greater increases in positive emotion and greater declines in depressive and anxious emotion between the day before and immediately after the test. Participants with lower mother’s education also show relatively lower levels of positive emotion and higher levels of depressive emotion on the day before the test, but no differences in positive and depressive emotion on the day of the test. Participants with lower

mother's education also show relatively higher levels of depressive emotion on both the day before and the day of the test, although this effect was significantly larger on the day before the test. *Note.* \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .





**Figure 2.** Positive emotion (a) and depressive emotion (b) as a function of test day and mother's education at low (left) and high (right) exam score. Participants with lower mother's education showed significant increases in positive emotion (a) and significant decreases in depressive emotion only when they performed worse on the test. *Note.* \* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

**Table 1.**

Emotion as a function of Test Day and Mother's Education.

| Variable                      | Positive Emotion    |      |                     |      |                      |      | Depressive Emotion   |      |                      |      |                      |      | Anxious Emotion   |      |         |      |      |  |
|-------------------------------|---------------------|------|---------------------|------|----------------------|------|----------------------|------|----------------------|------|----------------------|------|-------------------|------|---------|------|------|--|
|                               | Model 1             |      | Model 2             |      | Model 1              |      | Model 2              |      | Model 1              |      | Model 2              |      | Model 1           |      | Model 2 |      |      |  |
|                               | B                   | SE   | B                   | SE   | B                    | SE   | B                    | SE   | B                    | SE   | B                    | SE   | B                 | SE   | B       | SE   |      |  |
| Constant                      | 2.73 <sup>***</sup> | 0.06 | 2.73 <sup>***</sup> | 0.13 | 2.15 <sup>***</sup>  | 0.06 | 2.00 <sup>***</sup>  | 0.13 | 2.49 <sup>***</sup>  | 0.07 | 2.44 <sup>***</sup>  | 0.14 | 0.00              | 0.05 | 0.03    | 0.05 | 0.06 |  |
| Test Day                      | 0.00                | 0.05 | 0.03                | 0.05 | -0.11 <sup>*</sup>   | 0.05 | -0.12 <sup>*</sup>   | 0.05 | -0.13 <sup>*</sup>   | 0.06 | -0.14 <sup>*</sup>   | 0.06 | 0.06 <sup>*</sup> | 0.02 | 0.02    | 0.02 | 0.02 |  |
| Mother's Education            | 0.06 <sup>*</sup>   | 0.02 | 0.05                | 0.03 | -0.09 <sup>***</sup> | 0.02 | -0.08 <sup>**</sup>  | 0.02 | -0.12 <sup>***</sup> | 0.03 | -0.11 <sup>***</sup> | 0.03 | 0.02              | 0.02 | 0.02    | 0.02 | 0.02 |  |
| Test Day × Mother's Education | -0.06 <sup>**</sup> | 0.02 | -0.06 <sup>**</sup> | 0.02 | 0.04 <sup>*</sup>    | 0.02 | 0.06 <sup>*</sup>    | 0.02 | 0.05                 | 0.02 | 0.05 <sup>*</sup>    | 0.02 | 0.06 <sup>*</sup> | 0.02 | 0.02    | 0.02 | 0.02 |  |
| Exam                          | -0.12 <sup>*</sup>  | 0.05 | -0.13 <sup>*</sup>  | 0.06 | 0.23 <sup>***</sup>  | 0.05 | 0.23 <sup>***</sup>  | 0.05 | 0.37 <sup>***</sup>  | 0.06 | 0.36 <sup>***</sup>  | 0.06 | 0.01              | 0.04 | 0.01    | 0.04 | 0.04 |  |
| Exam Score                    | 0.01                | 0.04 | 0.00                | 0.04 | -0.04                | 0.04 | -0.01                | 0.04 | 0.01                 | 0.04 | 0.01                 | 0.04 | 0.01              | 0.04 | 0.01    | 0.04 | 0.04 |  |
| Female                        | —                   | —    | -0.18               | 0.11 | —                    | —    | 0.15                 | 0.11 | —                    | —    | 0.37 <sup>**</sup>   | 0.12 | —                 | —    | —       | —    | —    |  |
| Latino                        | —                   | —    | 0.26                | 0.15 | —                    | —    | -0.13                | 0.15 | —                    | —    | -0.43 <sup>*</sup>   | 0.17 | —                 | —    | —       | —    | —    |  |
| Asian American                | —                   | —    | 0.17                | 0.11 | —                    | —    | 0.06                 | 0.11 | —                    | —    | -0.30 <sup>*</sup>   | 0.12 | —                 | —    | —       | —    | —    |  |
| Other Race                    | —                   | —    | 0.01                | 0.18 | —                    | —    | -0.07                | 0.18 | —                    | —    | -0.30                | 0.20 | —                 | —    | —       | —    | —    |  |
| Health                        | —                   | —    | 0.19 <sup>***</sup> | 0.04 | —                    | —    | -0.22 <sup>***</sup> | 0.04 | —                    | —    | -0.20 <sup>***</sup> | 0.04 | —                 | —    | —       | —    | —    |  |
| Impact of COVID-19 on Mood    | —                   | —    | -0.09               | 0.05 | —                    | —    | 0.26 <sup>***</sup>  | 0.05 | —                    | —    | 0.27 <sup>***</sup>  | 0.05 | —                 | —    | —       | —    | —    |  |

Note.

\*  $p < .05$

\*\*  $p < .01$

\*\*\*  $p < .001$ .

Model 1 does not adjust for covariates and Model 2 adjusts for covariates; Test Day was dummy-coded as 0 = day before the test, 1 = day of the test; Exam was dummy-coded as 0 = fourth exam, 1 = fifth exam Exam Score was standardized; Mother's Education, Exam Score, Health, and Impact of COVID-19 on Mood were mean-centered; Gender and Race were dummy-coded (male = 0, female = 1; White as reference group, compared with Asians, Latinos, and people of other races or biracial). Model 1 tested interactions with Mother's Education and Model 2 tested interactions for Subjective Social Status.