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A day in the life of a college student during the COVID-19 pandemic: An experience sampling approach to emotion regulation

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Abstract

COVID-19 has contributed to unexpected stressors in daily life, and emotion regulation is an important area of research during and post-pandemic to gain knowledge of the effect of the pandemic on emotion regulatory processes. We adopted an ecologically valid approach to collect 10 experience sampling events within the same day to examine how college students regulated their emotions on a typical weekday during the pandemic and the simultaneous hedonic association of these strategies on their affective experience. Several emotion regulation strategies (including acceptance, calming, reappraisal, problem solving, and social sharing) were associated with increased positivity or reduced negativity that may be better for psychological health. In contrast, other emotion regulation strategies (including rumination, experiential avoidance, catastrophizing, lack of clarity, self-blaming, and other-blaming) were associated with increased negativity or reduced positivity that may worsen psychological health. In these findings, self-reported stress was a crucial contextual moderator to consider while understanding the relationship between emotion regulation strategies and experienced affect. The current study documents variability in affect in response to stressors experienced by college students even within a single day and provides a real-world perspective on the

emotion regulation strategies that were adaptive and maladaptive in the context of the COVID-19 pandemic.

KEYWORDS
affect, COVID-19, daily stressors, emotion regulation, experience sampling methodology

INTRODUCTION

The COVID-19 pandemic has triggered unforeseen health, economic, and socioemotional challenges (Gruber et al., 2020). The pandemic has led to decreased life satisfaction, positive affect, and increased reported mental health difficulties (e.g., Gruber et al., 2020; Gubler et al., 2020; Hager et al., 2020). Specifically, pandemic-related stressors have increased students' anxiety and depressive symptoms (Lee et al., 2021; Tasso et al., 2021). Some of these stressors include health concerns, academic performance, financial decline, and fewer social interactions (e.g., Hager et al., 2020; Kecojevic et al., 2020; Tasso et al., 2021). In addition, individuals who struggled to regulate their stress or avoided thinking about the COVID-19 pandemic had higher anxiety and depression (Kar et al., 2020). Indeed, dysfunctional emotion regulation can further aggravate mental health challenges and lead to long-term psychological consequences (Gruber et al., 2020). In contrast, adaptive emotion regulation strategies can ameliorate negative affect and promote psychological well-being (Aldao et al., 2010). Examining individual differences in emotion regulation abilities may shed light on different ways individuals respond to daily stress during (and outside) a pandemic. Thus, emotion regulation will continue to be an important area of research during and post-pandemic to gain knowledge of the effect of the pandemic on emotion regulatory processes. In the current study, we investigated how emotion regulation was associated with affect in the context of a naturally occurring global pandemic.

Emotion regulation is how individuals attempt to modify the duration, intensity, and type of affective states they experience (Gross, 1998). Individuals are generally thought to be motivated by hedonic purposes (to help an individual feel pleasant experience) to downregulate negative and upregulate positive affect (Larsen & Prizmic, 1999); however, non-hedonic goals (to enable adaptive functioning, irrespective of pleasant experiences) may also motivate emotion regulation (Koole, 2009; Tamir, 2016). Individuals use various emotion regulation strategies to regulate their affective experiences. While there are many emotion regulation strategies (e.g., Parkinson & Totterdell, 1999), prior literature (Aldao et al., 2010; Gross, 2015; Naragon-Gainey et al., 2017; Webb et al., 2012) and this current study have focused on a few emotion regulation strategies typically employed by individuals. These include reappraisal, distraction, social sharing, acceptance, calming, problem solving, rumination, lack of clarity, suppression, experiential avoidance, catastrophizing, self-blame, and other-blame. Several theoretical frameworks have been developed to classify emotion regulation strategies (for reviews, see Gross, 2015; Koole, 2009; Naragon-Gainey et al., 2017). One useful way to classify emotion regulation strategies is based on their association with psychopathology and psychological functioning. Past reviews have examined the links between emotion regulation with psychopathology to identify strategies on the maladaptive–adaptive spectrum (Aldao et al., 2010; Gross, 2015; Naragon-Gainey et al., 2017). An adaptive strategy may be negatively

associated with psychopathology (e.g., acceptance and reappraisal). Conversely, a maladaptive emotion regulation strategy may be positively associated with psychopathology (e.g., experiential avoidance and rumination). Nevertheless, a strategy may not necessarily be maladaptive or adaptive; instead, it may be context-dependent (e.g., Aldao, 2013; Bonanno & Burton, 2014).

At the same time, individuals may use multiple emotion regulation strategies in parallel to manage stressful experiences (e.g., Brans et al., 2013; Brockman et al., 2017; Haines et al., 2016; Heiy & Cheavens, 2014; Webb et al., 2012). In this study, we examined 13 emotional regulation strategies that have been traditionally categorized as maladaptive versus adaptive in nature based on previous research (e.g., Aldao et al., 2010; Gross, 2015; Heiy & Cheavens, 2014; McMahon & Naragon-Gainey, 2019; Naragon-Gainey et al., 2017; Webb et al., 2012). The following six traditionally adaptive strategies were examined. Cognitive reappraisal refers to attempts to reframe one's thoughts on a situation to modify its emotional significance (Gross, 2015; Troy et al., 2018). Distraction involves focusing one's attention on other activities away from emotional-eliciting experiences (Brans et al., 2013; Gross, 1998). Social sharing refers to interacting with others about one's emotional experiences (Brans et al., 2013; McMahon & Naragon-Gainey, 2019). Acceptance is defined as nonjudgmental acceptance of one's experiences (Brans et al., 2013). Calming reflects attempts to soothe one's body by taking deep breaths or relaxing muscles (Gruber et al., 2013). Problem solving involves conscious efforts to explore ways to address the emotional problem at hand (Aldao et al., 2010).

In addition, the following seven traditionally maladaptive strategies were examined. Rumination involves a repetitive focus on thoughts associated with adverse events (Garnefski & Kraaij, 2006). Lack of clarity is a poor understanding of one's emotions (Gratz & Roemer, 2004). Expressive suppression refers to deliberate attempts to inhibit the expression of emotional behavioral responses (Gross & Thompson, 2007). Experiential avoidance reflects attempts to avoid unwanted experiences, including thoughts, feeling, or sensations (Gratz & Roemer, 2004; McMahon & Naragon-Gainey, 2019). Catastrophizing is defined as thoughts focused on an extremely tragic version of one's negative experiences (Garnefski & Kraaij, 2006). Self-blame involves thoughts focused on placing the blame for one's experiences on oneself (Heiy & Cheavens, 2014). Finally, other-blame involves thoughts of placing the blame of one's experiences on others (Garnefski & Kraaij, 2006).

Additionally, intra-individual and inter-individual effects can independently and orthogonally explain variability in an outcome variable (e.g., Boy & Sumner, 2014). Therefore, it is crucial to examine both intra-individual and inter-individual variations in emotion regulation strategies. Depending on the context (situation and goals), individuals may implement different emotion regulation strategies with varying success at regulating their affect. An examination of *intra-individual variations* can shed light on the within-individual associations of implementing different emotion regulation strategies to manage affect. In contrast, *inter-individual variations* can explain between-individual differences in utilizing emotion regulation strategies. For example, some individuals may be more likely to adopt social sharing or rumination to manage their emotions. Such tendencies may be associated with better or worse psychological functioning during the pandemic. As intra- and inter-individual differences in the use of emotion regulation strategies can have independent effects on affect, direct inclusion of both would refine our understanding of emotion regulation and affect associations. Therefore, we separately accounted for intra- and inter-individual relationships between emotion regulation strategies and affect.

The current study examined the interplay between emotion regulation strategies and affective experiences of college students throughout a day during the COVID-19 pandemic. We adopted experience sampling methodology (e.g., Brans et al., 2013; Haines et al., 2016; Heiy & Cheavens, 2014) to capture affective experiences in their naturalistic settings (including emotion regulation strategies, stress, and affect levels). Past work has found that the duration of 80% of emotional episodes is about an hour (Verduyn et al., 2009). Therefore, as a useful extension of previous emotion regulation research that typically samples every 2–3 h, the current study collected samples within an hour to capture most emotional experiences during the course of a day. More frequent sampling of emotional experiences (10 experience sampling events within the same day) reduced reliance on retrospection and thus provided a more refined understanding of affect and emotion regulation associations during the pandemic. Two research questions were examined. First, how are intra- and inter-individual emotion regulation strategies associated with affect experienced within a day during the COVID-19 pandemic? Second, how may stress moderate the relationship between emotion regulation strategies and affect? There is some evidence that stress levels can explain the effectiveness of some emotion regulation strategies, including reappraisal (Johnson et al., 2016) and suppression (Richardson, 2017). This past work provided the motivation to examine the role of stress levels experienced while understanding the relationship between emotion regulation strategy and affective experiences.

Recent work has suggested that a strategy may not necessarily be adaptive or maladaptive, and the context may determine the nature of its association with affect (e.g., Aldao, 2013; Bonanno & Burton, 2014). However, the COVID-19 pandemic was a novel context, and no prior studies of emotion regulation strategies were available to make predictions specific to this pandemic. Therefore, we used findings from previous reviews (e.g., Aldao et al., 2010; Gross, 2015; Heiy & Cheavens, 2014; McMahon & Naragon-Gainey, 2019; Naragon-Gainey et al., 2017; Webb et al., 2012) conducted before the COVID-19 pandemic as guidelines to make predictions about emotion regulation strategies and affect links during the pandemic. Specifically, for our first research question, we hypothesized that intra- and inter-individual variabilities in traditionally adaptive emotion regulation strategies would be associated with decreased negative affect or increased positive affect. These predictions were based on past research on reappraisal (Aldao et al., 2010; Webb et al., 2012), distraction (Augustine & Hemenover, 2009; Webb et al., 2012), social sharing (Heiy & Cheavens, 2014; McMahon & Naragon-Gainey, 2019), acceptance (Aldao et al., 2010; McMahon & Naragon-Gainey, 2019; Webb et al., 2012), calming (Gruber et al., 2013), and problem solving (Young et al., 2021). In contrast, we hypothesized that intra- and inter-individual variabilities in traditionally maladaptive strategies would be associated with increased negative affect or decreased positive affect. These predictions were based on previous research on rumination (Garnefski & Kraaij, 2006; Gross & John, 2003), lack of clarity (Gratz & Roemer, 2004), suppression (Garnefski & Kraaij, 2006; Gross & John, 2003), experiential avoidance (Brans et al., 2013), catastrophizing (Garnefski & Kraaij, 2006; Gross & John, 2003), self-blame (Heiy & Cheavens, 2014), and other-blame (Heiy & Cheavens, 2014).

Our second research question was primarily exploratory in nature because limited past literature was available to make specific predictions about the impact of stress on all the emotion regulation strategies that were examined. Given that stress levels can moderate the links between emotion regulation strategies and affect (e.g., Johnson et al., 2016; Richardson, 2017), we expected that the stress levels experienced within the day by individuals might moderate the relationship between an emotion regulation strategy and experienced affect.

METHOD

Participants

Ninety-three adults (M_{age} = 21.17 years old, *SD* = 2.88 with 84.9% females, 12.9% males, 1.1% genderqueer, and 1% others) participated in this study. The sample included 68.75% who were Caucasian, 10.71% were Hispanic or Latino, 7.14% were Asian or Asian American, 1.79% were African American, .89% were American Indian or Alaskan, 5.36% were biracial or a mixture of backgrounds, and 5.36% others. The study protocol was in accordance with the Institutional Review Board at the University of Utah. Participants were recruited from the university's subject pool and received research credit for their participation. The highest level of education completed by this sample was 14% high school diploma, 9.7% college freshman, 19.4% college sophomore, 49.5% college junior, 5.4% bachelor's degree, and 1.1% master's degree.

Measures and materials

A web-based application, SurveySignal (Hofmann & Patel, 2015), was used to set up participants' phones to receive text messages automatically. The following experience sampling measures were used.

Stressors and stress levels

At each sampling event, participants reported any personally relevant stressors they were experiencing from a list of stressors including work/academic (e.g., deadlines), home (e.g., chores), negative self (e.g., self-doubt), pandemic related (e.g., wearing mask, social distancing), negative perceptions of others (e.g., rude), government (e.g., politics), argument/disagreement with anyone (e.g., partner), financial stress (e.g., rent), health related (e.g., getting sick), traveling/commute (e.g., traffic), environmental (e.g., waste), discrimination (e.g., race), and other. They were told, "Since you last indicated, check all the stressors that you have experienced." See Table S1 in the supplementary document for details. Additionally, to assess their overall stress levels at each sampling event, participants were asked to rate how much stress they felt on a scale of 0 (*not at all*) to 4 (*a great deal*).

Emotion regulation strategies

Participants reported the extent to which they tried to regulate their responses to personally relevant stressors by employing each of the emotion regulation strategies. They were asked, "Because of all the stressors you selected above, how much were you doing each of the following?" on a 5-point scale, 0 (*not at all*) to 4 (*a great deal*). Participants were presented with 13 items that described emotion regulation strategies, that is, one item for each strategy. These items were adapted from past studies (e.g., Brans et al., 2013; Garnefski & Kraaij, 2006; Gratz & Roemer, 2004; Gruber et al., 2013; Heiy & Cheavens, 2014; Lohani et al., 2020; McMahon & Naragon-Gainey, 2019). See Table 1 for details.

TABLE 1 Means, standard deviations, and intraclass correlation coefficients for emotion-regulation strategies

Strategy	Item	*M*	*SD*	*ICC*
Rumination	I could not stop thinking about my past and current problems	1.13	1.27	.585
Lack of clarity	I had difficulty making sense out of my feelings	0.77	1.05	.572
Reappraisal	I changed the way I think about what causes my feelings	0.73	0.99	.549
Suppression	I avoided expressing my emotions	1.05	1.25	.547
Experiential avoidance	I pushed down my feelings or put them out of my mind	1.13	1.22	.525
Social sharing	I talked about my feelings with others	0.86	1.16	.419
Self-blame	I criticized myself for my feelings	0.73	1.06	.504
Distraction	I engaged in activities to distract myself from my feelings	1.52	1.25	.352
Acceptance	I allowed space for whatever is going on, rather than trying to create some other state	1.26	1.18	.338
Calming	I tried to calm my body by taking deep breaths or relaxing muscles	1.00	1.15	.493
Problem solving	I looked for possible solutions to fix my problem	1.55	1.23	.324
Catastrophizing	I thought that what I have experienced is much worse than what others have experienced	0.34	0.75	.538
Other-blame	I thought about the mistakes others have made, which aggravated my problems	0.60	1.01	.475

Negative and positive affect

Negative and positive affect were assessed using a modified differential emotion scale (Watson et al., 1988). The scale included eight negative emotions (sadness, irritable, bored, anger, lonely, helpless, hopeless, and useless) and seven positive emotions (happiness, enthusiastic, love, proud, peace, purposeful, and amazement). At each experience sampling event, participants were asked, "Since you last indicated, how much of the following do you feel." They rated each word on a scale of 0 (*not at all*) to 4 (*a great deal*). Then, a mean negative affect and positive affect were calculated for each sampling event by averaging all the negative and positive words, respectively. The sample had good reliability with Cronbach's alpha of .88 and .89 for negative and positive affect, respectively.

Procedure

All data were collected on regular weekdays during the Fall 2020 semester. Participants signed the consent form in accordance with the protocol approved by the Institutional Review Board. On the day of the study, participants received 10 text messages between 10 a.m. and 8 p.m. A semi-random beep design was adopted to avoid anticipatory behaviors that would occur when each text's timing would be known (Brans et al., 2013). Accordingly, participants' phones were set up to receive one text message randomly within each hour. Participants received a Qualtrics survey link in each text to report their affect levels and emotion regulatory efforts. Each experience sampling event took less than 5 min to complete.

Data analysis plan

Table S2 in the supplementary document presents the correlation coefficients for the main predictors and outcome variables. Similar to past research (e.g., Brans et al., 2013), there were positive intra-individual correlations between different emotion regulation strategies hinting at the simultaneous use of multiple strategies at the same time or in close succession. To account for the possible use of more than one strategy at a time, we decided to include all emotion regulation strategies in the same model. Participants were treated as a random intercept in all the models. Linear mixed models were fit to address research question 1 regarding the relationship between emotion regulation strategies and affect. The main effect terms for all emotion regulation strategies were included in each model. To address research question 2 regarding the role of stress on emotion regulation and affect links, stress levels were included as a moderator in all models. As a result, in addition to all the main effects of emotion regulation strategies, the main effect of stress and terms for all two-way interactions between stress and emotion regulation strategies were included. Note that the findings for the main effects of emotion regulation strategies were similar with or without stress (and its higher-order terms). To report parsimonious models, nonsignificant interaction terms were dropped from the model (Bates, Kliegl, et al., 2015; Bates, Maechler, et al., 2015). In case stress significantly interacted with an emotion regulation strategy, the inference was restricted to the higher-order interaction term (Venables, 1998). To understand the interaction terms, the association between negative affect and emotion regulation strategy was plotted and tested with simple slopes tests at high (+1 *SD*) and low (−1 *SD*) stress levels.

Next, we provide an overview of all the models. Given that intra-individual and inter-individual components are orthogonal (e.g., Boy & Sumner, 2014), separate models for each component were run. To analyze the *intra-individual* relationships, within-subject components of all emotion regulation strategies and stress levels were included as predictors of negative (Model 1) and positive (Model 2) affect (see Table 2). To model the effect of intra-individual variance, we had a subject mean-centered value for each emotion regulation strategy at each experience sampling event. This allowed us to interpret each strategy's effect in relation to each participant's mean (Enders & Tofighi, 2007). For example, at each sampling event, the values reflect the degree to which an individual employed reappraisal relative to their mean. The equations for Models 1 (negative affect) and 2 (positive affect) are presented below where i = measurement occasion (1st–10th experience sampling event); j is Participants; m = Strategy (separate parameters for each of the 13 strategies); n = Strategy x Stress interaction terms (separate parameters for each strategy):

Level 1 (event-level):

$$\text{Affect}_{ij} = \beta_{0j} + \beta_{1j}(\text{Time}) + \beta_{2j}(\text{Stress}) + \Sigma\beta_{mj}\,(\text{Strategy}) + \Sigma\beta_{nj}\,(\text{Strategy} \times \text{Stress}) + e_{ij}$$

Level 2 (person-level):

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

$$\beta_{2j} = \gamma_{20}$$

TABLE 2 Intra-individual components of all emotion regulation strategies and stress predicted negative affect (Model 1) and positive affect (Model 2)

	Model 1: Negative affect					Model 2: Positive affect				
Predictors	Estimates	Std. error	*t*-value	*df*	*p*	Estimates	Std. error	*t*-value	*df*	*p*
(Intercept)	0.7	0.07	9.4	102.7	<.001	1.51	0.09	17.33	123.9	<.001
Time	<0.01	<0.01	−0.34	604.7	.73	−0.03	0.01	−3.43	613	.001
Rumination	0.09	0.02	4.79	599.9	<.001	<.01	0.03	−0.16	603.8	.873
Lack of clarity	0.09	0.02	4.07	599.7	<.001	−0.03	0.03	−0.97	602.8	.333
Suppression	0.01	0.02	0.43	599.3	.667	0.06	0.03	1.88	602.7	.061
Exp. avoidance	−0.02	0.02	−0.98	599.4	.327	−0.08	0.03	−2.63	602.7	.009
Self-blame	0.05	0.02	2.46	599.7	.014	0.05	0.03	1.67	602.7	.095
Catastrophizing	−0.01	0.03	−0.41	600	.681	<.01	0.04	0.01	604.1	.996
Other-blame	0.07	0.02	3.8	599.5	<.001	−0.04	0.03	−1.41	604.1	.159
Reappraisal	−0.05	0.02	−2.31	599.6	.021	0.04	0.03	1.3	603.4	.195
Social sharing	<0.01	0.02	0.2	599.7	.843	0.04	0.03	1.53	603.5	.127
Acceptance	−0.04	0.01	−2.78	600.1	.006	0.08	0.02	3.5	603.7	<.001
Calming	−0.03	0.02	−1.5	599.6	.133	0.06	0.03	2.22	602.9	.027
Problem solving	−0.03	0.01	−1.82	599.7	.07	0.01	0.02	0.47	603.3	.642
Distraction	0.01	0.01	1.07	600.6	.286	−0.03	0.02	−1.2	605.5	.23
Stress	0.17	0.02	9.63	600	<.001	−0.18	0.03	−6.27	603.7	<.001
Lack of clarity * Stress	0.08	0.03	3.28	604.6	.001					
Self-blame * Stress	−0.05	0.03	−2.05	605	.041					
Catastrophizing * Stress	0.15	0.03	4.82	607.1	<.001					
Distraction * Stress	−0.04	0.02	−2.02	609.4	.044					
Other-blame * Stress						−0.12	0.04	−3.43	625.1	.001

TABLE 3 Inter-individual components of all emotion regulation strategies and stress predicted negative affect (Model 3) and positive affect (Model 4)

	Model 3: Negative affect					Model 4: Positive affect				
Predictors	Estimates	Std. error	*t*-value	*df*	*p*	Estimates	Std. error	*t*-value	*df*	*p*
(Intercept)	0.04	0.14	0.29	83.98	.775	1.53	0.22	6.83	82.68	<.001
Time	−0.01	0.01	−1.55	657.5	.121	−0.02	0.01	−3.31	654.7	.001
Other blame	0.55	0.07	7.3	79.74	<.001	−0.06	0.12	−0.52	79.63	.602
Social share	0.09	0.07	1.32	76.28	.19	0.26	0.11	2.33	76.75	.023
Acceptance	−0.08	0.08	−1.02	75.97	.309	−0.12	0.13	−0.96	76.38	.339
Calming	<0.01	0.07	−0.06	80.1	.951	0.03	0.11	0.3	79.93	.768
Problem solving	−0.04	0.07	−0.53	77.58	.595	0.25	0.12	2.09	77.7	.04
Distraction	0.04	0.07	0.62	79.94	.537	0.1	0.11	0.9	79.93	.373
Stress	0.18	0.06	3	79.25	.004	−0.31	0.1	−3.16	79.39	.002

$$\beta_{mj} = \gamma_{m0}$$

$$\beta_{nj} = \gamma_{n0}$$

To analyze the *inter-individual* relationships, between-subject components of all emotion regulation strategies and stress levels were included as predictors of negative (Model 3) and positive (Model 4) affect (see Table 3). The inter-individual variance was modeled by including the subject mean for each strategy, which allowed us to compare each individual's overall score. For example, a high reappraiser would have a higher subject mean than a low reappraiser. The equations for Models 3 (negative affect) and 4 (positive affect) are presented below where i = measurement occasion (1st–10th experience sampling event); j is Participants; m = Strategy (separate parameters for each of the 13 strategies); n = Strategy x Stress interaction terms (separate parameters for each strategy):

Level 1 (event-level):

$$\text{Affect}_{ij} = \beta_{0j} + \beta_{1j}(\text{Time}) + \beta_{2j}(\text{Stress}) + e_{ij}$$

Level 2 (person-level):

$$\beta_{0j} = \gamma_{00} + \Sigma\gamma_{m0}\,(\text{Strategy}) + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

$$\beta_{2j} = \gamma_{20} + \Sigma\gamma_{n0}\,(\text{Strategy})$$

All statistical models were fit using the R language for statistical computing. The lme4 package (Bates, Mächler, et al., 2015) was used to run mixed-effects models. *t*-tests used Satterthwaite's method (Bates, Mächler, et al., 2015). A standard collinearity identification and correction method was followed (Zuur et al., 2010). Any predictor with a higher variance inflation factor (VIF) score than a preselected threshold of 2 (a stringent threshold) was dropped from the final model. The models reported in Tables 2 and 3 are presented after removing collinearity issues.

RESULTS

Participant compliance

On average, participants completed 8.56 (SD = 2.155) out of 10 surveys; 47.1% completed all 10 surveys, 23% completed 9, and 10.3% completed 8; 6.9% completed 6, 3.4% completed 6, and 9.1% completed 5 or less.

Stressors and stress level

Students reported experiencing the stressors from multiple domains; see Table S1 in the supplementary document. In the order of frequency, these included work or academic, home, negative self, pandemic-related stressors, negative perceptions of others, government, argument/disagreement with anyone, financial stress, health-related, traveling/commute, environmental, and discrimination. Students reported at least one stressful event 37.2% of times, two stressors, 26.4% of the time, three or more stressors 15.1% of the time, four or more stressors 10.5% of the time, and five more stressors 10.9% of the time. On average, the overall stress level reported by participants was 2.08 (SD = 1.23) and an intraclass correlation coefficient (ICC) = .60.

Negative and positive affect

Negative affect had a mean of .69 (SD = .75) and an ICC = .738. Positive affect had a mean of 1.38 (SD = .89) and an ICC = .62.

Association between emotion regulation strategies and affect: Intra-individual effects

See Table 1 for means, standard deviations, and ICCs for emotion-regulation strategies. The ICCs reflect a substantial variability in strategy use at both intra- and inter-individual levels. Tables 2 and 3 present the results from the linear mixed-effects models to understand the relationship between emotion regulation strategies and affect. Model 1 tested how negative affect was predicted by time, intra-individual components of all emotion regulation strategies, and moderated by stress and higher-order interaction terms. Greater use of rumination and other-blame was associated with higher negative affect, and greater acceptance and reappraisal was associated with lower negative affect. At the intra-individual level, time, suppression, experiential avoidance, social sharing, calming, and problem solving were not significantly associated with negative affect.

In addition, lack of clarity interacted with stress levels. Figure 1a shows the association between negative affect and lack of clarity moderated by stress using simple slopes at low (−1 SD) and high (+1 SD) levels. A slope test revealed that, for low-stress levels, there was no significant association (p = .39), but, for high-stress levels, higher lack of clarity was associated with higher negative affect (b (SE) = .15(.02), p < .01). Catastrophizing also interacted with stress; see Figure 1c. A slope test revealed that higher catastrophizing for high-stress levels was associated with higher negative affect (b (SE) = .10(.03), p < .01) relative to lower-stress levels, when higher catastrophizing was associated with lower negative affect (b (SE) = −.12(.04), p < .01). Furthermore, self-blame significantly interacted with stress; see Figure 1b. A slope test indicated that for high-stress levels, there was no association (p = .73), but for low-stress levels, higher use of self-blame was associated with higher negative affect (b (SE) = .09(.03), p < .01). Similarly, a slope test revealed that distraction interacted with stress, such that for low-stress levels, higher use of distraction was associated with higher negative affect (b (SE) = .04(.02), p = .03), but no association was found for high stress (p = .45); see Figure 1d. After accounting for multicollinearity, none of the other strategies interacted with stress (including rumination,

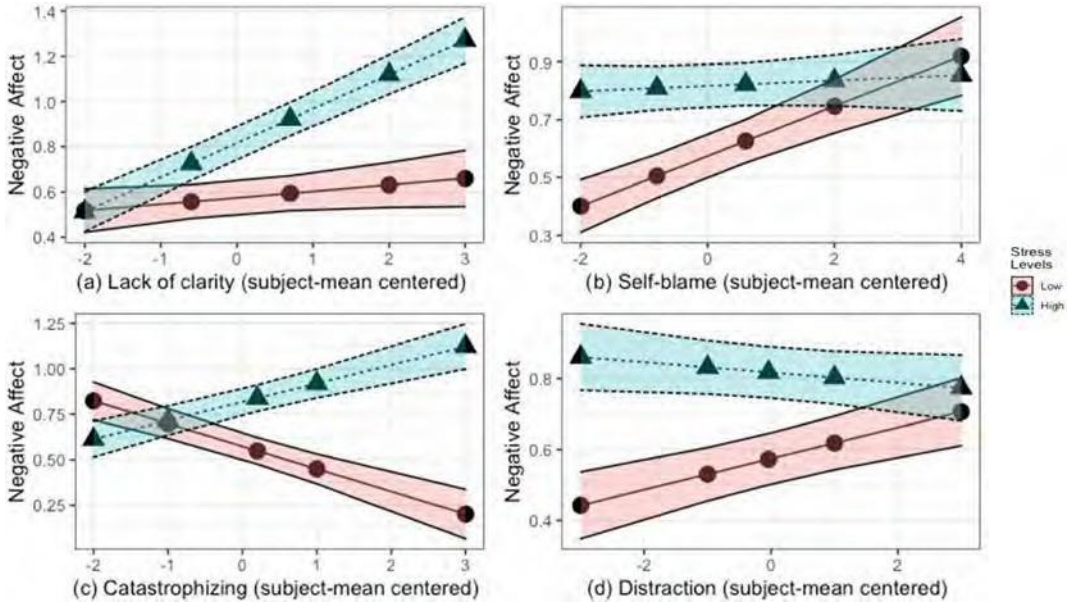

FIGURE 1 The association between negative affect and (a) lack of clarity, (b) self-blame, (c) catastrophizing, and (d) distraction was moderated by stress levels

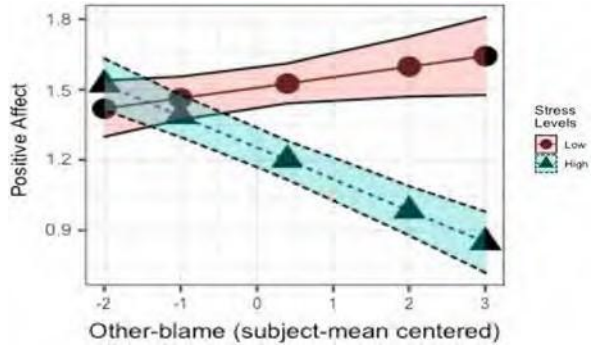

FIGURE 2 The association between other-blame and positive affect was moderated by stress levels

suppression, experiential avoidance, other-blame, reappraisal, social sharing, acceptance, calming, and problem solving).

Model 2 tested how positive affect was predicted by time, intra-individual components of all emotion regulation strategies, and moderated by stress and higher-order interaction terms. At an intra-individual level, greater experiential avoidance was negatively associated with positive affect, and greater use of acceptance and calming was positively related to positive affect. A significant effect of time was found with a decrease in positive affect through the day. At the intra-individual level, rumination, lack of clarity, suppression, self-blame, catastrophizing, reappraisal, and social sharing were not significantly associated with positive affect. None of the other strategies interacted with stress after accounting for multicollinearity, except other-blame. A slope test revealed that other-blame interacted with stress such that when individuals

were experiencing high-stress levels, higher other-blaming was negatively associated with positive affect (b (SE) = −.14(.04), $p < .01$), but no such association was found for low-stress levels ($p = .33$). See Figure 2.

Association between emotion regulation strategies and affect: Inter-individual effects

Model 3 was run to test how negative affect was predicted by time, inter-individual (between) components of all emotion regulation strategies, and moderated by stress and higher-order interaction terms; see Table 3. At an inter-individual level, other-blamers were significantly associated with negative affect. College students experiencing higher average stress levels during the day also experienced higher negative affect. None of the other strategies and interaction terms with stress were significant at the inter-individual level, including social sharing, acceptance, calming, problem solving, and distraction.

Model 4 tested how positive affect was predicted by time, inter-individual components of each emotion regulation strategy, along with stress and its two-way interaction terms. Higher-stress levels were negatively associated with positive affect. Conversely, social sharers and problem solvers at a between-individual level were related to experiences of higher positive affect. None of the other strategies and interaction terms with stress were significant at the inter-individual level, including other-blame, acceptance, calming, and distraction.

DISCUSSION

COVID-19 has contributed to unexpected stressors in daily life, and adaptive emotion regulation is essential for maintaining psychological health. The current study adopted an ecologically valid approach to examine how college students regulated their emotions on a typical weekday during the pandemic and the simultaneous hedonic association of these strategies with their affective experience. An important contribution of this study is that it documents how traditionally adaptive and maladaptive strategies were associated with affect experienced within a day during the COVID-19 pandemic. We found that individuals selected and implemented multiple emotion regulation strategies to regulate their affect. There was significant variability in strategy usage at within and between individual levels within the same day. Even after accounting for the use of all 13 strategies together, some emotion regulation strategies had a significant association with affect (see Table S3 in the supplementary document). We found that acceptance and reappraisal were associated with a lower negative affect, and acceptance, calming, social sharing, and problem solving were associated with higher positive affect. Thus, several emotion regulation strategies were associated with better psychological health in the context of the COVID-19 pandemic. In contrast, rumination and other-blaming were associated with higher negative affect, and experiential avoidance was associated with lower positive affect. These findings imply that several strategies were also associated with poor psychological health. Another theoretical contribution of the current study is that stress was found to be a key individual-centered contextual moderator that should be considered while understanding affect-emotion regulation links. Notably, the association between affect and emotion regulation strategies (including lack of clarity, catastrophizing, self-blame, other-blame, and distraction) was moderated by stress intensity. Together, this study provides a real-world perspective on the emotion

regulation strategies that were adaptive and maladaptive in the context of the COVID-19 pandemic. Below, we discuss the contribution and implications of these findings.

College students in this study reported experiencing stressors in multiple life domains, especially concerning work and academics, home, negative self-perception, and pandemic-related stressors. We considered strategies traditionally regarded as adaptive from a hedonic perspective (e.g., Aldao et al., 2010; Gross, 2015; Naragon-Gainey et al., 2017) that would be associated with a better affective experience. Consistent with hypotheses, acceptance of stressors, reappraisal, and calming were associated with better psychological health (including reduced negative affect or improved positive affect). The findings with acceptance and reappraisal are similar to another experience sampling study that examined a student sample and found that acceptance and reappraisal were negatively associated with negative affect (McMahon & Naragon-Gainey, 2019). Overall, these findings are consistent with previous reviews that found a small-to-moderate effect of acceptance and reappraisal (Aldao et al., 2010; Webb et al., 2012). Acceptance can lead to a faster recovery from distressing situations (Karnaze & Levine, 2020), and the current findings suggest that acceptance may be a good way to deal with the stressors during the pandemic.

Along the same lines, the use of cognitive reappraisal is generally associated with higher positive and lower negative affect and higher well-being (Aldao et al., 2010; Richardson, 2017; Webb et al., 2012). In fact, acceptance and reappraisal were associated with lower distress and higher well-being during the COVID-19 pandemic (Park et al., 2021). However, some recent work has questioned whether reappraisal is actually always adaptive (Ford & Troy, 2019; Haines et al., 2016). Instead, reappraisal can be an adaptive emotion regulation strategy in uncontrollable situations but maladaptive in relatively controllable situations (Haines et al., 2016). Some individuals could have perceived the COVID-19 pandemic to be controllable as they could afford specific actions to control it based on contextual factors, such as their ability to adhere to social distancing guidelines, job demands, and socioeconomic status (e.g., Jackson-Koku & Grime, 2019; Troy et al., 2018). However, others could have perceived the pandemic as uncontrollable as they could not control its impact and when it ended. The current study did not explicitly ask participants how controllable they found their stressors, and further work is needed to examine this critical factor.

Problem solving (Aldao et al., 2010) and social sharing (McMahon & Naragon-Gainey, 2019) are two emotion regulation strategies that are generally considered adaptive. Both, problem solving and social sharing, can provide resources to regulate emotions effectively and are associated with adaptive psychological health (e.g., Aldao et al., 2010; Götmann & Bechtoldt, 2021; Uchino et al., 2016; Urry & Gross, 2010). Consistent with this past work, we found that problem solving and social sharing styles (at a between-individual level) were associated with better affect. Problem solving involves actively changing the stressors themselves, and the current findings highlight its value associated with regulating daily stressors in naturalistic settings during the pandemic. With regard to social sharing, our findings are also in line with previous research that found that it was associated with positive affect (McMahon & Naragon-Gainey, 2019). Moreover, higher social sharing was associated with lower distress and higher well-being during the COVID-19 pandemic (Park et al., 2021). These findings suggest that social sharing was a helpful buffer worth maintaining while meeting the health and safety guidelines for COVID-19.

We also considered strategies traditionally regarded as maladaptive (e.g., Aldao et al., 2010; Gross, 2015; Naragon-Gainey et al., 2017) and their association with affective experiences in daily life during the pandemic. Ruminative thinking is thought to exasperate negative emotions

(Garnefski & Kraaij, 2006; Gross & John, 2003) and has been identified as an underlying mechanism for developing depression (Hager et al., 2020). Consistent with past research, rumination was associated with negative affect. At the same time, experiential avoidance was negatively related to the experience of positive affect. In line with these findings, recent work has found that university students who avoided thinking about the COVID-19 pandemic experienced high anxiety and depression (Kar et al., 2020; Lee et al., 2021; Tasso et al., 2021). Furthermore, students experiencing moderate to severe mental health difficulties may not seek professional help (Lee et al., 2021). The current findings were generally consistent with the between-person avoidance factor (including rumination, suppression, behavioral avoidance; McMahon & Naragon-Gainey, 2019). Overall, these traditionally maladaptive emotion regulation strategies (including rumination and experiential avoidance) were found to be associated with worse affect experienced within a day during the pandemic. More generally, individuals implementing maladaptive emotion regulation on a regular basis may be especially vulnerable to the challenges imposed by COVID-19 and should receive resources to support themselves during the pandemic.

Furthermore, accounting for experienced stress levels helped understand the relationship of affect with traditionally maladaptive strategies (Aldao et al., 2010; Gross, 2015; Naragon-Gainey et al., 2017), including other-blame, self-blame, catastrophizing, and lack of clarity. A lack of clarity, as well as catastrophizing, was associated with exacerbated negative affect, especially during high-stress states. Both worsen negative emotions and contribute to emotional vulnerabilities (Garnefski & Kraaij, 2006; Gratz & Roemer, 2004; Gross & John, 2003). The current findings extend this past literature on exacerbated negative affect being associated with lack of clarity and catastrophizing to daily stress in the context of the COVID-19 pandemic. In contrast, self-blame was associated with negative affect during lower stress levels. Self-blame can increase with negative experiences (Heiy & Cheavens, 2014). Indeed, self-blame during the COVID-19 pandemic has been reported to be negatively associated with mental health (Dewa et al., 2021; Götmann & Bechtoldt, 2021; Zacher & Rudolph, 2020). Extending this past work, we found that higher self-blame was associated with experiences of higher negative affect, particularly during low-stress states. In contrast to self-blame, higher other-blame was associated with lower positive affect, particularly during high-stress states. Whereas some past work did not find a significant association between other-blame and affect (Heiy & Cheavens, 2014), we found that other-blaming (within-individual level) was associated with affect after accounting for stress levels. Furthermore, those who were other-blamers (between-individual level) were related to the experience of higher negative affect. Thus, while it may be hard to avoid, blaming self or others may be related to poor psychological health. The above findings also highlight the importance of considering stress levels as an individual-centered contextual moderator.

Distraction is one of the most frequently used strategies (Brans et al., 2013), and it is traditionally considered hedonically adaptive (Augustine & Hemenover, 2009; Webb et al., 2012). However, McMahon and Naragon-Gainey (2019) found that the distraction contributed to a within-subject factor that was related to negative affect. The current study extends these findings and suggests that stress levels moderate the relationship between distraction and affect. Distraction was related to higher negative affect during low stress. The findings with distraction being maladaptive during low-stress situations during the pandemic highlight the drawbacks of assuming a strategy to be adaptive or maladaptive in all contexts. Moreover, this finding supports the strategy-situation fit hypothesis that suggests that a strategy may be maladaptive or adaptive depending upon the context (e.g., Aldao, 2013; Bonanno &

Burton, 2014). Contextual moderators that are situation-centered (such as controllability of stressors; Haines et al., 2016) and individual-centered (e.g., the intensity of stressors experienced; Ford & Troy, 2019) may determine the strategy-situation fit. Thus, even though it may be easy to implement distraction (Brans et al., 2013), its use should be tailored to the stress levels being experienced by individuals.

Consistent with a past daily diary study (Johnson et al., 2016), the current work found that reappraisal was negatively associated with negative affect independently; however, we did not find that stress moderated the association between reappraisal and negative affect (c.f., Johnson et al., 2016). Furthermore, inconsistent with another study (Richardson, 2017), we did not find that stress moderated the association between suppression and positive affect. A possible explanation for these differences is that the current study examined a combination of 13 strategies and their interaction with stress, and it is possible that after accounting for other strategies, stress did not moderate the unique effects of reappraisal or suppression on affect. Another notable difference is that the current study was conducted within a day versus other work in which the daily diary method across a few days. Further work is needed to understand better the moderating role of stress on the association between affect and emotion regulation strategies.

Despite the encouraging findings, there are a few limitations of this study. First, students reported experiencing multiple stressors, and the current study was not designed to examine each stressor separately. In future work, it would be helpful to study the effectiveness of emotion regulation strategies in the context of specific stressors. Second, this study was designed to examine associations between affect and emotion regulation strategies by collecting 10 samples within a day. However, it would also be helpful to know this association varies over weeks, and future work is needed in this direction. Third, participants may have implemented emotion regulation strategies other than the 13 strategies examined in this study. Finally, it would also be beneficial to know if individuals found the stressors to be controllable (Haines et al., 2016). Additional research is needed to evaluate how the controllability of stressors may impact the effectiveness of emotion regulation strategies.

CONCLUSION

From an applied perspective, the current study documents the variability in affect and emotional regulation in response to stress experienced by college students even within a single day during the COVID-19 pandemic. Our findings revealed that several emotion regulation strategies (including acceptance, calming, reappraisal, problem solving, and social sharing) were associated with increased positivity or reduced negativity that may be better for psychological health in the context of the COVID-19 pandemic. In contrast, certain emotion regulation strategies were associated with increased negativity or reduced positivity that may worsen the psychological health of college students (including rumination, experiential avoidance, catastrophizing, lack of clarity, self-blaming, and other-blaming). In these findings, stress levels experienced by individuals were an important contextual moderator that should be considered while understanding the relationship between emotion regulation strategies and experienced affect. The current study documents variability in affect and emotional regulation in response to stressors experienced by college students even within a single day during the COVID-19 pandemic. This study provides a real-world perspective on the emotion regulation strategies that were adaptive and maladaptive in the context of the COVID-19 pandemic. This research

has implications for students whose mental health has been severely impacted by psychological challenges during the pandemic (e.g., anxiety, depression, and loneliness; Gubler et al., 2020; Hager et al., 2020; Kecojevic et al., 2020). The current findings highlight the need for a mental health support system to help students implement emotion regulation strategies associated with healthy psychological outcomes.

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CONFLICT OF INTEREST

We have no conflicts of interests to disclose.

ETHICS STATEMENT

The study protocol was in accordance with the Institutional Review Board at the University of Utah.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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