COVID-19 Stressors, Cognitive Reappraisal, and Students' Engagement in Online Learning: A Mediation Model

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Abstract

The effects of COVID-19 remained significant on university students' social and academic well-being. The pandemic raised various mental and psychological challenges for the students, and had the potential to deteriorate their academic engagement and performance in online learning environments. The emotion regulation theory hypothesizes that various cognitive skills including cognitive reappraisal may assist people in coping with such types of social and psychological challenges. This study aimed to investigate the influence of cognitive reappraisal "as a mediator" on the relationships between COVID-19 stressors and university students' engagement in an online learning environment. Three hundred and one students selected from eight public sector universities in Pakistan participated in a survey. Three instruments, including the COVID-19 Related Stressors, Cognitive Reappraisal Questionnaire, and Student Engagement Dimensions, were used to collect data. Mediation analysis confirmed the application of emotion regulation theory in the context of relationships between COVID-19 stressors and students' engagement in online learning environments. The study has significant implications for promoting students' engagement in online setups during stressful situations.

Keywords: Emotion regulation, pedagogical stress, online learning, cognitive engagement, psychological distress

COVID-19 has impacted higher education institutions drastically across the globe. Data showed that 89.4% of the total enrolled learners were affected due to the pandemic in 185 countries worldwide till April 2020 (Marinoni et al., 2020). Many institutions remained closed due to extended lockdowns and other preventive measures. Although online learning and distance education were present in many countries as an option for learners in the pre-COVID-19 period, the pandemic triggered an emergency shift to the online mode of learning, leaving it as the only source of learning for a large number of students (Lockee, 2021). The pandemic has had a major impact on the way that students participate in the classroom (Di Pietro, 2023). Many classrooms became either fully online or a hybrid of online and in-person learning. This has led to an increase in the use of technology to facilitate participation, such as video conferencing, discussion boards, and remote collaboration tools (Aad, 2024). It has also led to a decrease in physical interaction between students and teachers, and an increase in the need for students to be self-motivated and take initiative in their learning. Teachers have had to be creative in finding ways to engage their students and ensure that everyone is able to access the learning materials and keep up with the curriculum. The disruption of routines, social isolation, financial difficulties, and fear of infection all impacted students' presence and performance in online learning and created various academic and psychological problems for them (Munir et al., 2021). The COVID-19 pandemic has had a significant impact on students' mental health. (AlAteeq et al., 2020; Khawar et al., 2021). As a result, there has been a marked increase in the prevalence of certain psychiatric disorders. These include depression, anxiety, post-traumatic stress disorder (PTSD), sleep disturbances, substance abuse, and suicide attempts. These disorders can potentially influence the students' performance and engagement in online settings (Kurt et al., 2022).

Managing psychiatric disorders can be a complex and challenging process. Managing the psychiatric issues of students can be a daunting task for educators. It is important to recognize that mental health is as important as physical health, especially for students. There are several strategies that educators can take to help manage the psychiatric issues of students and create an inclusive environment. Research demonstrates that multiple factors reduced the effect of psychiatric disorders on the students' academic engagement during the pandemic (Kara, 2022). Various cognitive functions like students' problem solving skills have contributed to a reduction in COVID-19 fear in their presence in online learning activities (Munir et al., 2021). The problem-solving skills and emotion regulation are two distinct characteristics that have potential to influence how individuals respond to fears and fear-triggered stress. These skills help students to identify, understand, and change their thought patterns and behaviors in order to better manage their psychiatric disorder (Wang & Yin, 2023). These strategies are used to help students in becoming more aware of their thoughts and how they are impacting their behavior and moods.

The situation related to the COVID-19 pandemic has caused a great deal of stress, confusion, and uncertainty in people's lives. As a result, individuals are facing a range of mental health challenges. One way to manage these challenges is to focus on problem-solving skills to help cope with stress and uncertainty. Problem-solving skills can help students identify potential solutions to the challenges they face and can also provide a sense of control and purpose. Problem-solving skills can help students to find creative solutions to address academic concerns related to the pandemic, as well as managing stress and anxiety. Additionally, problem-solving skills can help students develop strategies to maintain social distancing and remain connected to

family and friends during this difficult time. By utilizing problem-solving skills, students can take an active role in managing their stress and anxiety related to the pandemic and make a positive impact on their overall mental health.

Explaining the nature of stress, Rudland et al. (2020) claimed that stress is not always a dilemma for students' learning. It may influence students' behaviors positively. They used the term *eustress* (good stress) to conceptualize the positive association of stress (good stress) with the learning activities. *Eustress* is a type of stress that is considered to be beneficial and motivating. It is caused by events or situations that are challenging and exciting and can lead to increased performance and improved well-being. Examples of *eustress* include participating in a competitive sporting event, taking on a difficult project at work, or embarking on a new adventure. Unlike distress, which is caused by overwhelming or negative experiences, *eustress* is associated with positive feelings, such as enthusiasm and motivation to cope challenges. Emotion regulation theories are fundamentally helpful in differentiating the influence of *eustress* and stress on students' academic performance and engagement (Kobylińska & Kusev, 2019). The present study focused on examining the mediatory contribution of emotion regulation strategies to explain relationships between COVID-19stressors and students' engagement with online learning during the pandemic.

Constructs of Interest

Student engagement (SE) has been defined in multiple ways depending on various learning theories. Kuh (2001) explained that SE is students' involvement in activities and conditions that are linked with high-quality learning. Students' participation in learning activities is given vital space in this conception. Jimerson et al. (2003) extended the SE concept postulating that it has multiple dimensions. These dimensions include affective, cognitive, and behavioral aspects of students' personalities that work to shape students' interests, attention, and passion for learning. Student engagement is the amount of interest, enthusiasm, and commitment a student has towards their education and the learning process. It involves taking ownership of one's learning and being actively involved in the process. Examples of student engagement may include actively participating in class discussions, completing assignments on time, working collaboratively with peers, and showing enthusiasm and interest in the subject matter (Buelow et al., 2018). Students' technology-related skills and attitudes towards digital learning environments emerge as additional factors in defining students' engagement in online environments (Chiu, 2022).

Students can engage with online learning environments in a variety of ways. They can interact with the content, engage with their peers, ask questions, and participate in activities. They can also use discussion boards, blogs, and chatrooms to collaborate and share ideas. Additionally, they can use social media, webinars, and video conferencing to stay connected. They can also use virtual learning environments such as simulations, games, and virtual reality to enhance their learning experience. Many students and teachers related factors along with those related to learning environment that affected student engagement in online settings during the COVID-19 pandemic (Kurt et al., 2022; Means & Neisler, 2021). However, most of the literature on student engagement lacks a clear distinction between the state of engagement, factors that

influence student engagement, and the immediate and longer-term consequences of engagement (Kahu, 2013).

Research to explain the association between stress and student engagement offers inconsistent findings. For example, Quigley et al. (2022) have reported an indirect association between stress and student engagement in online classes during the pandemic. On the other hand, Rudland et al. (2020), have supported the idea of *eustress* (good stress), claimed that stress is not bad for students' learning. They reported a direct association of (good) stress with student learning. *Eustress* can help students' learning in a variety of ways. Students may find that a certain level of stress can help them focus and stay motivated to complete tasks, allowing them to learn more quickly and efficiently. Additionally, stress can help students stay organized and manage their time better, further improving their learning experience. Finally, eustress can also help inspire students to work harder and achieve their goals, as they strive to overcome challenges and achieve success.

Within the conceptualization of good and bad stresses, this study investigated the contribution of cognitive reappraisal in mediating the association between COVID-19 stressors and students' engagement in online classes. Cognitive reappraisal, as a facet of emotion regulation, is making changes in thinking about a situation or phenomenon to decrease its emotional influence (Gross & Thompson, 2007). It is an effective emotion regulation strategy to strengthen the process of controlling and regulating negative sentiments in the human mind. It involves changing the way a person interprets and responds to a situation or emotion-eliciting stimulus. This type of emotion regulation involves reframing the situation in order to alter the emotional response. It involves focusing on more positive aspects of the situation or on more constructive ways of responding. Cognitive reappraisal can be used to reduce negative emotions and increase positive emotions. Research has shown that cognitive reappraisal can be an effective tool for managing emotions. It can help people to better regulate their emotions and to respond to situations in a more adaptive way (Gross & Thompson, 2003).

Literature provides evidence that cognitive reappraisal correlates to people's efforts to control psychiatric disorders (Zhao et al., 2021). Studies have found that cognitive reappraisal can be an effective tool for managing symptoms of psychiatric disorders such as depression, anxiety, and post-traumatic stress disorder. Cognitive reappraisal can help individuals learn to reframe difficult experiences in a more positive light, challenge irrational beliefs that may be maintaining their distress, and identify more adaptive ways of responding to difficult situations. Research also suggests that cognitive reappraisal may help individuals with psychiatric disorders better regulate their emotions, reduce their symptoms, and improve overall functioning. To understand the concept of good stress, this research hypothesizes that COVID-19 stressors have the potential to trigger cognitive reappraisal in students. The cognitive reappraisal, consequently, is expected to demonstrate a positive association with student engagement in online classes.

COVID-19 Related Stressors

COVID-19-related stress is a common form of stress experienced by many people in the world. It is caused by the fear, anxiety, and uncertainty associated with the pandemic. It may manifest itself in physical symptoms such as headaches, chest pain, and trouble sleeping. It may also lead to emotional symptoms such as fear, anxiety, depression, and anger. The COVID-19 outbreak and subsequent lockdowns caused mental and psychological problems in the majority

population across the world (Serafini et al., 2020). Malik and Javed (2021) have identified three categories of stressors that emerged during the COVID-19 period among university students. These categories include COVID-19-related academic, psychological, and social stressors. This study used a combination of these three stressors as an independent variable.

Engagement in Online Learning

Student engagement in online learning refers to their active involvement in online learning practices offered by their institutions. This involvement is generally aligned with the educational and learning objectives (Chiu, 2022). Reeve (2012) has explained that students' engagement has four dimensions: behavioral, cognitive, emotional, and agentic. Behavioral engagement shows students' involvement in learning activities and may comprise attention, participation, effort, intensity, or persistence. Cognitive engagement shows students' mental efforts to accomplish learning tasks. Emotional engagement is students' feelings towards overall learning experiences. Agentic engagement depicts the acts of taking initiatives that contribute to learning. Chiu (2022) has followed these dimensions to gauge student engagement in online learning during COVID-19. This inquiry adopted overall student engagement (a combination of behavioral, cognitive, emotional, and agentic engagement) in online learning as a dependent variable.

Cognitive Reappraisal

People use different strategies to control and regulate their emotions. Cognitive reappraisal is among the significant emotional regulating strategies to cope with the psychiatric effects of COVID-19 in students (Zhao et al., 2021). This cognitive strategy is used at an individual level to regularize thought processes in stressful situations. It relies on changing thinking about a problem to decrease its emotional stress (Gross & Thompson, 2007). Cognitive reappraisal is commonly used as meditating process to facilitate effectiveness of cognitive behavior therapy (Clark, 2022). It involves changing the way of thinking about a situation and demands reinterpretation of that situation. The new interpretation is reappraisal of the given situation or event in a more objective way without associating negative feelings and thoughts with that phenomenon. It, resultantly, changes the individual's emotional response to that situation. However, literature suggest that this modified emotional response may vary from person-to-person and is not always positive (Dawel et al., 2023). The present study accepted cognitive reappraisal (an effective emotional regulation strategy) as a mediator variable to explain the relationship between COVID-19 stressors and student engagement with online learning activities.

Research Procedure

Research objectives, and the nature of hypothesized relationships are essential to consider while selecting research design for studying mediation models. A survey design allows collecting data at a single point of time and is suitable for studying mediating relationships between the variables which are simultaneously measured (MacKinnon, 2008). Three hundred and one undergraduate students in eight public sector universities in Punjab, Pakistan, participated in the survey. Multi-phase sampling procedure was followed to recruit the participants. Four out of 47 public sector universities were randomly selected in the first phase of sampling. Four departments from each university were randomly selected in the second phase of

the sampling. Twenty students from each department were randomly selected in the third sampling phase. Consequently, a sample of 320 undergraduate students was identified. Incomplete data of 19 students were excluded from the analysis. The original sample size used in the data analysis was 301 undergraduate students. 80% of the respondents were females, whereas two respondents preferred not to disclose their sexual identity. The mean age of the respondents was 21.92 years (SD = 3.28), ranging from 17 to 30 years. The participants came from different academic disciplines. 22% of the respondents were enrolled in laboratory or practical courses during the online sessions. The rest of the students were enrolled in online classes that did not require laboratory or experimental work. The following instruments were used to collect the data.

COVID-19 related stressors: A 14-item scale to gauge the respondents' perceptions about COVID-19 stressors was adopted from Malik and Javed (2021). The scale measured three major COVID-19 associated stressors, including academic (7 items), psychological (4 items,) and social (3 items) factors. Sample items of this scale include "Online education during COVID-19 has increased my academic workload" (academic stressor), "I had the constant fear of losing grades during COVID-19" (psychological stressor), and "My family suffered due to my over-engagement in academic work during the pandemic" (social stressor). Perceptions were collected on a 5-point Likert scale ranging from "highly disagree" (1) to "highly agree" (5). The scale demonstrated Cronbach's Alpha of .88. The three constructs, i.e., academic, psychological, and social stressors, showed Cronbach's Alpha of .77, .77, and .68, respectively.

Cognitive Reappraisal Questionnaire: A "Emotion Regulation Questionnaire" was developed by Gross and John (2003) to measure two facets of emotion regulations named "Cognitive Reappraisal" and "Expressive Suppression." The 6-item construct to measure the presence of cognitive reappraisal in the respondents was adopted for this study. The questionnaire collected information on a 7-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (7). Sample items in the questionnaire include "When I'm faced with a stressful situation, I make myself think about it in a way that helps me stay calm" and "I control my emotions by changing the way I think about the situation I'm in." The questionnaire demonstrated a Cronbach's Alpha of .81.

Student Engagement Dimensions: An instrument to gauge student engagement in online education was adopted from Chiu (2022). The 21-item scale measured four student engagement dimensions: behavioral, cognitive, emotional, and agentic. The perceptions were collected on a 5-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (5). Sample items in the subscales include "In online classes, I worked as hard as I could" (behavioral engagement), "I let my teacher know what I needed and wanted" (agentic engagement), and "When I studied for online classes, I tried to connect what I was learning with my own experiences" (cognitive engagement), and "When we worked on something in online classes, I felt interested" (emotional engagement). The behavioral, cognitive, emotional, and agentic engagement factors demonstrated Cronbach's Alpha .84, .89, .82, and .80, respectively. The combined scale showed Cronbach's Alpha .94.

Collected data were recorded in an SPSS file. The three instruments were constructed on different scales. COVID-19 stressors and student engagement dimensions were scaled on 5-point scales whereas cognitive reappraisal questionnaires measured the construct on 7-point scales. Z-scores of each variables/items were calculated to get standardized scores before conducting Confirmatory Factor Analysis (CFA). The CFA was preferred on the EFA (Exploratory Factor Analysis) because construct models of the three instruments adopted in this study were pre-specified. Underlying structures of the three instruments were established by empirical analyses through EFA in previous studies. Brown (2015) justified running CFA instead of EFA in such situations. The purpose of running CFA was to test that the observed variables measured the latent (unobserved) constructs or factors as hypothesized in the theoretical models of these instruments. The CFA also facilitated the establishment of construct validity of the three instruments. Results of the CFA provided evidence on the fitness of factorial structures of the three instruments used in this study. Although the value of chi-square 3125.557 was significant on this model, values of other indices supported the factorial distribution of the three variables (Table 1). Factor loadings of each statement in the corresponding factors remained higher ($> .5$) in the CFA except an item of cognitive reappraisal (Factor loading = 0.30) and an item of student engagement (Factor loading = 0.44), who demonstrated comparatively lower values. However, these items were retained in the scales because the factors loading of these items were not below 0.30 (Hair et al., 2022). We preferred to retain factorial structures of the original instruments. Detailed factors loadings are available in Appendix A.

Table 1

Values of Different Fitness Indices

Index	Value
Goodness of Fit Index (GFI)	0.96
Comparative Fit Index (CFI)	0.96
Bollen's Relative Fit Index (RFI)	0.94
Bollen's Incremental Fit Index (IFI)	0.96
Tucker-Lewis Index (TLI)	0.96
Bentler-Bonett Non-normed Fit Index (NNFI)	0.96
Bentler-Bonett Normed Fit Index (NFI)	0.95
Parsimony Normed Fit Index (PNFI)	0.89

Descriptive and inferential statistics were calculated on the non-standardized scores. A mediation analysis was conducted using PROCESS Macro model 4 (Hayes, 2022) in SPSS to draw conclusions. Certain limitations of using mediation analysis for testing relationships in true causal sequence were considered in designing and implementing the research design for this study. These limitations were addressed using a rigorous research procedure and providing evidence-based conclusions of the study. This research used mediation analysis to understand mechanism by which an independent variable affects a dependent variable through a mediator variable. The mediator variable mediates the relationship between the independent and dependent variables. No hierarchical control variables (e.g., age, gender, classroom type) were added to the mediation analysis. However, random sampling procedure was followed at different phases of sampling to reduce the influence of such variables on the mediation model. The absence of hierarchical control variables in the mediation analysis protected the model from

being overly complex. Simpler models enhance clarity of the findings and make interpretations more focused and meaningful. The findings drawn from the data analysis are reported underneath.

Findings

Data showed that the three types of COVID-19 stressors prevailed in the students (Table 2). The students faced COVID-19-related academic, psychological, and social stress during the pandemic. The presence of various dimensions of student engagement (i.e., behavioral, agentic, cognitive, and emotional) and cognitive reappraisal is evident in the data (Table 2). The correlation table demonstrated that the cognitive reappraisal had significant direct correlations with the independent and dependent variables and their sub-factors.

Mediation analysis was conducted using PROCESS Macro in SPSS to investigate the hypothesis that cognitive reappraisal mediates the effect of perceived stress on students' engagement. The PROCESS model 4 was run in the analysis. Results indicated that perceived stress was a significant predictor of cognitive reappraisal, $B = .86$, $SE = .30$, 95% CI [.21, 1.43], $\beta = .51$, $p = .00$ and cognitive reappraisal was a significant predictor of student engagement, $B = .18$, $SE = .03$, 95% CI [.10, .25], $\beta = .30$, $p = .00$. These results support the mediational hypothesis. Perceived stress was not a significant predictor of student engagement after controlling for the mediator, cognitive reappraisal, $B = -.04$, $SE = .06$, 95% CI [-.17, .09], $\beta = -.04$, $p = .51$, consistent with full mediation. The predictors accounted for approximately 8% of the variance in student engagement ($R^2 = .08$). The indirect effect was tested using a percentile bootstrap estimation approach with 10000 samples implemented with the PROCESS macro version 4 (Hayes, 2022). The results indicated the indirect coefficient was significant $B = .15$, $SE = .04$, 95% CI [.08, .23]. Perceived stress was associated with student engagement which was approximately .15 points higher as mediated by cognitive reappraisal.

Table 2

Descriptive Statistics

Scales (Range)	Alpha	Mean	SD	Skewness	Kurtosis
COVID-19-related stressors (1-5)	.88	3.51	.68	-.42	-.09
Academic stressor	.77	3.49	.72	-.50	.05
Psychological stressor	.77	3.68	.81	-.67	.09
Social stressor	.68	3.31	.86	-.14	-.44
Student engagement (1-5)	.94	3.50	.68	-.62	.52
Behavioral engagement	.88	3.51	.81	-.66	.34
Agentic engagement	.89	3.51	.78	-.46	-.04
Cognitive engagement	.82	3.61	.79	-.71	.51
Emotional engagement	.80	3.40	.81	-.56	.04
Cognitive reappraisal (1-7)	.81	4.84	1.15	-.83	.47

Table 3

Correlations for Study Variables (n = 301)

	Variables	1	2	3	4	5	6	7	8	9	10
1	COVID-19-related stressors (Combined)	-									
2	Academic stressor	.93**	-								
3	Psychological stressor	.89**	.73**	-							
4	Social stressor	.76**	.55**	.57**	-						
5	Student engagement (Combined)	.11	.09	.07	.14*	-					
6	Behavioral engagement	.01	.02	.01	-.00	.82**	-				
7	Agentic engagement	.15*	.12*	.11	.18*	.93**	.70**	-			
8	Cognitive engagement	.16*	.14*	.13*	.14*	.85**	.60**	.77**	-		
9	Emotional engagement	.05	.03	.01	.13*	.79**	.47**	.65**	.57**	-	
10	Cognitive reappraisal	.51**	.46**	.47**	.38**	.28**	.17**	.27**	.32**	.19**	-

*$p < .05$. **$p < .01$.

Figure 1

Unstandardized Regression Coefficients and Standard Errors
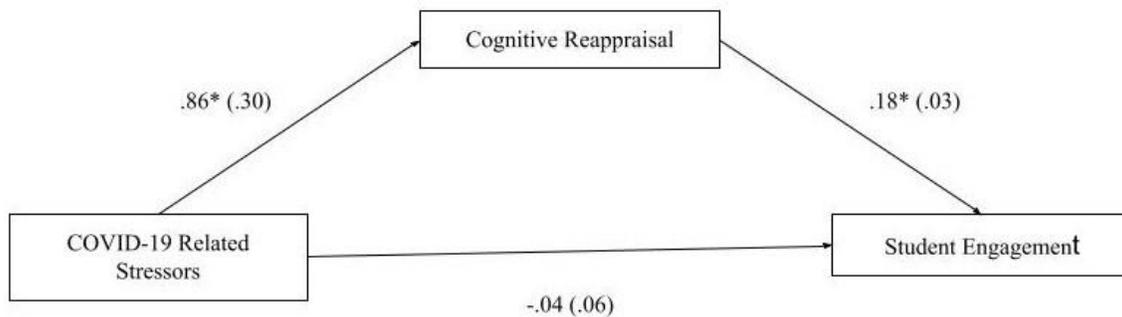
Discussion and Conclusions

The findings of the study demonstrated three significant dimensions. At the first glance, the presence of COVID-19 stressors, cognitive reappraisal, and student engagement is supported through the data. Viewing the COVID-19 outbreak and its effects on pedagogical practices in Pakistan (Abid et al., 2021), the students' concerns about their academic, social, and psychological well-being are evident in their perceptions of COVID-19 stressors. COVID-19 has caused a great deal of stress and anxiety for students. The sudden move to virtual learning has been a difficult adjustment and many students are feeling overwhelmed. Many students feel disconnected and unmotivated in the virtual learning environment, leading to low grades and a decrease in overall academic performance. Additionally, students may be facing a lack of access to resources, such as technology and reliable internet, which can further hinder their learning. Furthermore, students may be dealing with the stress of not being able to interact with their peers or having to manage multiple online classes at once. Such elements have contributed to various psychiatric problems in the students, including those related to academic practices (Hagedorn et al., 2022).

Data showed an above-average level student engagement with online learning (M=3.50, SD=.68) despite the presence of COVID-19 stressors. There is a significant direct relationship between the prevalence of COVID-19 stressors and student engagement with online learning (R=.14). The nature of the relationship between COVID-19-related psychiatric disorders and students' learning-related factors remained confused in the literature. Contrary to the findings of this inquiry, Khawar et al. (2021) have concluded an indirect association between psychological distress and student satisfaction from online learning in the Pakistani context. An increase in psychological distress has caused a reduction in student satisfaction with online classes in Khawar et al. study. The constructs of satisfaction from online classes and student engagement with online learning overlap. An analogy between psychological distress and COVID-19

stressors has emerged. However, the nature of relationships between COVID-19 stressors and student engagement with online learning is different from the nature of relationships between the prevalence of psychological distress and satisfaction from online learning. We explain this contradiction based on *eustress* (good stress). Rudland et al. (2020), in their study, found direct associations between stressors and learning in an online environment. They interpret the direct relationship between stressors and learning in the context of students' cognitive functions. They hypothesized that students' interpretation of and response to the stressor could make it either a positive challenge or a hindrance to learning. In other words, an individual's interpretations have the potential to make a hindrance a positive challenge. Our results presented a direct relationship between COVID-19 stressors and student engagement with online learning. To understand the nature of cognitive functions that have caused this direct relationship, we examined the contribution of students' cognitive reappraisal as a mediator.

Values of unstandardized regression coefficients and their respective significance levels calculated through mediation analysis confirmed the contribution of cognitive reappraisal in explaining the direct relationship between COVID-19 stressors and student engagement with online learning. This finding addressed the main hypothesis of the study that cognitive reappraisal may help individuals with stress to better regulate their emotions and improve their overall performance. The findings confirm that COVID-19 stressors have the potential to trigger cognitive reappraisal in students. And the cognitive reappraisal may demonstrate a positive association with student engagement in online classes. This finding is primarily aligned with the conception of emotion regulation postulated by Gross and Thompson (2007). Confusion about the relationship between stress and emotion regulation remained in the literature for a long time (Berking & Wupperman, 2012). This study contributed to the elimination of confusion in the literature regarding the relationships among stress, cognitive reappraisal, and student engagement and performance in online learning setting. Literature supports that levels and longevity of stress interact differently with people's reactions to stressors (Langer et al., 2020). Prevalence of the COVID-19 stressors was comparatively   shorter. Students' cognitive response to these stressors was not "bad". Students' cognitive response to COVID-19 in the shape of emotion regulations and cognitive reappraisal contributed to the indirect relationships between COVID-19 stressors and student engagement with online learning.

Munir et al. (2021) have conducted a comparative study to investigate mediating effects of cognitive problem-solving skills and psychological motivation on the relationship between fear of COVID-19 and students' social presence in online learning in Pakistani and Malaysian contexts. Their results demonstrate that cognitive problem-solving skills act as stimulus for promoting Malaysian students' interest in online learning during the COVID-19 pandemic. However, for Pakistani students, psychological motivation and cognitive problem-solving skills directly affect students' presence in online learning during the pandemic at the higher education level. Differences in the results of Pakistani and Malaysian data lead us to assume that different personal, social, religious, and academic factors may influence the reported relationships in this study. The majority of these factors were present in the Pakistani context to provide COVID-19-related guidelines to the students; however, these factors were not systematically studied in previous research. The current study examined and then concluded the contribution of cognitive reappraisal in explaining the direct effect of COVID-19 stressors on student engagement with online learning activities.

Although the data were collected during the second wave of COVID-19 in the first quarter of 2021, the findings have broader implications for students studying in uncomfortable or stressful situations. This research confirmed the contribution of cognitive reappraisal as a psychological strategy for reframing the way students interpret a challenging situation (COVID-19 stressors in this investigation) and changing its impact on themselves. These findings opened possibilities of investigating factors that have potential to explain how cognitive reappraisal converted a stressful situation into a positive force that, resultantly, promoted student engagement. The Pakistani context of this study determined its limitations. Generalization of the research findings to any other context will require careful consideration of factors that differentiate that context from the Pakistani one. Similarly, overall findings of the study are based on the conceptual model of this inquiry. The conceptual structures of the constructs and their expected relationships with each other—adopted in this study—are operationally explained in the section "Constructs of Interest." The findings of this study draw conclusions within the boundaries of these adopted conceptual frameworks.

Results of the research have implications for online education systems especially in Pakistan-like contexts. The results challenge common assumptions that are held by policymakers about the negative effects of stressors on students' mental and psychological engagements to their studies. This research provides evidence on the effectiveness of cognitive reappraisal as a mediator to convert unwanted effects of COVID-19 stressors on students' engagement with their learning practices. This evidence can be used by policymakers to make informed decisions to promote students' engagement in online education pandemics and other trauma-generating situations. In the wide range of education policy, stakeholders within the education system—especially management, instructional designers and curriculum coordinators, faculty, and others—might consider the promotion of students' cognitive reappraisal skills which in turn may strengthen student engagement with online education in unusual and stressed environments.

Declarations

On behalf of all authors, the corresponding author states that there is *no conflict of interest*.

Informed consents were obtained from all individual participants of the recent study.

Institutional research committee at Allama Iqbal Open University Islamabad, Pakistan granted *ethical approval* before the start of the research. All procedures performed in this research were in accordance with the ethical standards as approved by the institutional research committee.

Data Policy

The *datasets* generated during and/or analyzed during the recent study are available from the corresponding author upon request.

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Appendix A

Table A1

Factor Loading of the Items of COVID-19 Stressors, Cognitive Reappraisal, and Student Engagement

Items	Factor Loadings
COVID-19 Stressor 01	0.30
COVID-19 Stressor 02	0.48
COVID-19 Stressor 03	0.69
COVID-19 Stressor 04	0.69
COVID-19 Stressor 05	0.73
COVID-19 Stressor 06	0.68
COVID-19 Stressor 07	0.70
COVID-19 Stressor 08	0.74
COVID-19 Stressor 09	0.83
COVID-19 Stressor 10	0.61
COVID-19 Stressor 11	0.73
COVID-19 Stressor 12	0.73
COVID-19 Stressor 13	0.58
COVID-19 Stressor 14	0.53
Cognitive Reappraisal 01	0.53
Cognitive Reappraisal 02	0.60
Cognitive Reappraisal 03	0.68
Cognitive Reappraisal 04	0.70
Cognitive Reappraisal 05	0.80
Cognitive Reappraisal 06	0.70
Student Engagement in Online Learning 01	0.61
Student Engagement in Online Learning 02	0.63
Student Engagement in Online Learning 03	0.68
Student Engagement in Online Learning 04	0.68
Student Engagement in Online Learning 05	0.72
Student Engagement in Online Learning 06	0.72
Student Engagement in Online Learning 07	0.77
Student Engagement in Online Learning 08	0.79
Student Engagement in Online Learning 09	0.84
Student Engagement in Online Learning 10	0.80
Student Engagement in Online Learning 11	0.73
Student Engagement in Online Learning 12	0.71
Student Engagement in Online Learning 13	0.72
Student Engagement in Online Learning 14	0.78
Student Engagement in Online Learning 15	0.72
Student Engagement in Online Learning 16	0.70
Student Engagement in Online Learning 17	0.71
Student Engagement in Online Learning 18	0.44

Student Engagement in Online Learning 19	0.64
Student Engagement in Online Learning 20	0.64
Student Engagement in Online Learning 21	0.67